HANDBOOK

BRITISH ASSOCIATION

BRISTOL 1898

PRESENTED BY
The Librarian, 1906
WITHDRAWN FROM CHELSEA

LONDON BOROUGH OF LEWISHAM
LIBRARY SERVICE

Author

Title

BOOK STORE

Books or discs must be returned on or before the last date stamped on label or on card in book pocket. Books or discs can be renewed by telephone, letter or personal call unless required by another reader. After library hours use the Ansafone Service (01-698 7347). For hours of opening and charges see notices at the above branch, but note that all lending departments close at 1 pm on Wednesday and all libraries are closed on Sundays, Good Friday, Christmas Day, Bank Holidays and Saturdays prior to Bank Holidays.

METROPOLITAN
SPECIAL COLLECTION

ESTABLISHED 1834.

Wm. Cowlin & Son

Builders & Decorators,

HEAD OFFICES & WORKS:

Stratton Street, Bristol.

SPECIALITIES.

House Painting and Decorating.
High-class Joinery.

IN CLIFTON.

Successors to Lewis & Sons,

House Agents and Decorators,

25 & 29, VICTORIA STREET.

ESTABLISHED 1777.

MESSRS. WILLIAM COWLIN & SON are the Sole Appointed House Agents for Bristol and Clifton in connection with the Visit of the British Association. All communications having reference thereto should be addressed to—

25 & 29, VICTORIA STREET, CLIFTON.

Telephone—CLIFTON, 5517; BRISTOL, 254.

BRITISH ASSOCIATION,

BRISTOL, 1898.

HANDBOOK TO BRISTOL

AND THE NEIGHBOURHOOD

WITH MAP (IN EXCURSION PAMPHLETS)

PREPARED BY VARIOUS AUTHORS, FOR THE PUBLICATIONS SUB-COMMITTEE,

AND EDITED BY

BERTRAM M. H. ROGERS, B.A., M.D., B.Ch.

BRISTOL:
JOHN WRIGHT & CO., PRINTERS, STONE BRIDGE.

1898.

H3946

JOHN WRIGHT AND CO.,
PRINTERS AND PUBLISHERS, BRISTOL.

I4238

PREFACE.

THIS Handbook, presented to the members and associates of the British Association for the Advancement of Science, has been prepared under the direction of the Publications' Committee, and it is hoped will form a permanent record of the City of Bristol, and the position it holds among the cities of the United Kingdom, in the year 1898.

Great care was taken in the selection of the authors of the various articles, so that every department might be described and each branch of science might be represented by a high authority in the locality.

As will be seen from a perusal of the book, the authors have spared no pains in producing compact and, as far as space would allow, complete articles on the different subjects allotted to them, and the Committee wish to express their deep sense of gratitude to each and every author.

I also wish to return my hearty thanks to those who have so kindly, ungrudgingly and ably assisted me, and, should the Handbook meet with the approbation of the Members and Associates of the British Association, I shall feel that the time and labour involved in its preparation has not been misspent.

BERTRAM M. H. ROGERS.

11, York Place,
Clifton, Bristol.

CONTENTS.

	PAGE
PREFACE	7
GEOLOGICAL HISTORY OF THE NEIGHBOURHOOD OF BRISTOL *(By C. Lloyd Morgan)*	11
PRE-HISTORIC ARCHÆOLOGY OF BRISTOL *(By C. Lloyd Morgan and Arthur Bulleid)*	38
BRISTOL AND ITS NEIGHBOURHOOD IN ROMAN TIMES *(By A. T. Martin)*	51
MODERN HISTORY OF BRISTOL *(By John Latimer)*	56
ARCHITECTURAL FEATURES OF BRISTOL *(By J. Bramble)*	71
DOCKS, RIVER AND TIDES *(By John M. McCurrich)*	82
THE PORT OF BRISTOL	108
BRISTOL COMMERCE AND INDUSTRIES *(By Joseph Holman and Henry J. Spear)*	117
LOCAL GOVERNMENT AND TAXATION *(By Geo. Pearson)*	135
CHARITIES *(By Frederick W. Newton)*	154
METEOROLOGY—RAINFALL AND TEMPERATURE—*(By C. Lloyd Morgan and Bertram Rogers)*	164
PUBLIC HEALTH *(By D. S. Davies)*	175
THE BOTANY OF BRISTOL *(By J. W. White)*	183
BIRDS OF THE BRISTOL DISTRICT *(By Herbert C. Playne)*	192
REPTILES, AMPHIBIANS AND FISHES OF THE BRISTOL DISTRICT *(By H. J. Charbonnier and C. Lloyd Morgan)*	197
MAMMALS OF THE BRISTOL DISTRICT *(By H. J. Charbonnier and C. Lloyd Morgan)*	200
INSECTS OF THE BRISTOL DISTRICT *(By Alfred E. Hudd)*	204
EDUCATIONAL ORGANIZATION IN BRISTOL *(By C. W. A. Tait)*	207
BRISTOL PUBLIC LIBRARIES, PAST AND PRESENT *(By E. R. Norris Mathews)*	221
SCIENTIFIC SOCIETIES	228
INDEX	234

BRISTOL AND NEIGHBOURHOOD.

GEOLOGICAL HISTORY OF THE NEIGHBOURHOOD OF BRISTOL.

By C. LLOYD MORGAN.

BRISTOL is situate in a district of varied geological interest. Its picturesque and diversified scenery not only delights the eye of the lover of natural beauty, but affords admirable examples of sculptured relief, leading on the thoughtful observer to enquire into their mode of origin. The abundant organic remains which are stored and displayed in the Bristol Museum show how well the local rocks have repaid the careful search of the collector, while the economic products—coal, building-stone, road-metal, brick-clay, celestine, and iron-ochre—afford to the practical man what one of their number has described as some justification for the existence of stratified deposits.

I take it that the object of a writer in a British Association Handbook should be to sketch in free outline the salient features of the subject which is entrusted to him, and to give information rather to the general member than to the specialist. With this end in view I shall endeavour to trace the chief events in the geological drama of which the neighbourhood of Bristol has been the theatre.

The scene opens in Silurian times with the deposition of strata which are exposed at the surface in Tortworth Park, where, through the kindness of Lord Ducie, geologists will have an opportunity of examining them, and which stretch thence northwards to the Severn. Here John Phillips described beds of Ludlow Age containing thin bands with numerous fish-scales and teeth. The Silurian strata are composed of sandstones and shales with bands of limestone, and contain some of the characteristic trilobites and brachiopods of the period, examples of which are preserved in Lord Ducie's collection at Tortworth. But

perhaps one of the most interesting features of the older Silurian beds of this district (of Upper Llandovery age) is the occurrence of contemporary lava-streams, which show that this part of what is now Gloucestershire was then the theatre of volcanic activity. The igneous rock is quarried for road-metal near Damery Bridge, and its relations to the sedimentary strata have recently been rendered visible. The occurrence of these lavas is the more interesting since the Silurian strata of Wales have no such igneous rocks, the volcanic activity there being of earlier date.

The succeeding beds of Old Red Sandstone indicate a change of physical conditions. For the remains of marine organisms which characterize the Silurian strata do not occur in the Old Red Sandstone. A few fish-scales alone break the palæontological barrenness of these deposits which would seem to have been laid down in a land-locked area cut off from the Southern Devonian sea by some physical barrier. The nature of this barrier we cannot determine. Barren conglomerates, sandstones, and red shales occur throughout the district as far south as the Mendips, where they form the arched summits of the hills. But in the not-distant Quantocks, somewhat further south, we have marine beds of the Devonian type. Perhaps shoals and sandbanks stretched between the present sites of these two ranges of hills and separated the southern sea from the fresher waters of the Old Red Sandstone area, shifting at times, no doubt, further south, but never, so far as we know, allowing the marine deposits to advance further north.

The relations of the Silurian strata to their Old Red successors near Tortworth are difficult to determine with accuracy. There is undoubtedly much faulting. It is probable too that temporary uplift of the Silurian beds above the sea-level led to the removal by denudation of their upper strata, and thus allowed the basal Old Red conglomerates to lie directly on the bared surface of the older Silurian deposits of Upper Llandovery age. It is indeed questionable whether the Silurians of Gloucestershire, south of the

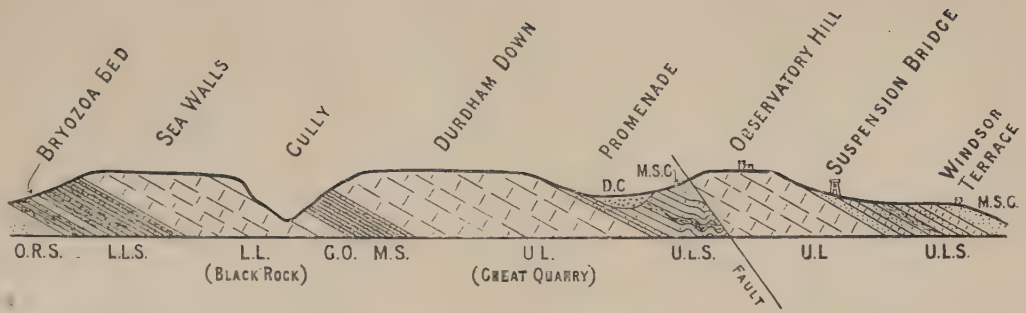
Severn, form, throughout the small area in which they are exposed, a conformable series without local breaks. Certainly, their distribution on the map is peculiar and difficult to account for by even the most ingenious introduction of hypothetical lines of fault. One is tempted to surmise that local upheavals, perhaps associated with the volcanic forces, rendered deposition irregular and prevented anything like the fuller and more uniform sequence which we find on the other side of the Severn. Unfortunately, exposures are few, and the country is difficult to map. And when we pass to the Old Red Sandstone, though its apparent thickness may have been somewhat reduced by faulting, we still have the remarkable fact that the beds of this age intervening between the Silurian and Carboniferous, forming in Herefordshire a series some thousands of feet in thickness, are to the west of Cromhall reduced to a band of but two or three hundred feet. However we account for the facts, whether we assume that we are here approaching the margin of the land-locked area of deposit, or regard the district as one of locally shallow water, we seem justified in regarding it as a region of limited sedimentation.

Nowhere else in this neighbourhood is the base of the Old Red Sandstone seen. But a considerable thickness (more than 1,500 feet) of its upper strata is found near Bristol, where it is well exposed in the Avon section, at Shirehampton, and, further south, in the Mendips. False-bedded sandstones, often ripple-marked, and conglomerates prevail in the upper strata. The conglomerates are sometimes cemented with calcareous matter, by the solution of which the rounded pebbles separate out as a loose gravel. The pebbles themselves are of distant origin and are composed of quartzite, jasper, porcellanite and igneous materials. Some of them may have been derived from the ancient rocks of St. David's, a conclusion in which I am supported by the opinion of Prof. Bonney, to whom a typical series of the pebbles was submitted. At Portishead scales of the fishes *Holoptychius*, *Coccosteus*, *Glyptopomus*, *Bothriolepis* and *Ceraspis* have been found, together with a tooth of *Conchodus* (probably).

Following conformably upon the Old Red Sandstone are the strata of the Carboniferous series, which are subdivided as shown in the following table.

Carboniferous Series.				feet.
Coal Measures ...	Upper	*a*	Radstock Series	2,000
		b	Farrington ,,	
	Middle ...		Pennant ,,	2,000
	Lower	*a*	Kingswood ,,	2,500
		b	Bristol ,,	
Millstone Grit				500
Carboniferous Limestone ...	Upper Limestone Shales			400
	Mountain Limestone ...			1,650
	Lower Limestone Shales			350
				9,400

The lower strata are well exposed in the Avon section, which, on account of its close proximity to our place of meeting, may be described in some detail and illustrated by a sketch section. Starting on the Gloucestershire side of the river, below Cook's Folly, the passage of Old Red Sandstone (O.R.S.) into the succeeding Lower Limestone Shales (L.L.S.) is well seen in the railway cutting, and is so gradual and uniform that an arbitrary division has to be drawn; a band of conglomerate containing small pebbles of milky quartz being regarded as the uppermost bed of the Old Red Sandstone. Above this the beds become calcareous and shaley and soon show evidence of marine life. A massive red band about eighty feet above the conglomerate is locally known as the "Bryozoa Bed" from the abundant remains of polyzoa (chiefly *Rhombopora*). The organic products have been converted into red oxide of iron, resisting the action of weak acid which dissolves the limestone matrix in which they are embedded. Crinoidal ossicles preponderate, but the polyzoa are also fairly numerous. The occurrence of bands of limestone in which the fossils are similarly converted into oxide of iron, at about this horizon, throughout the district from Tytherington on the north, to Burrington Combe in the Mendips on the south, seems to indicate the prevalence of some general conditions in the shallow sea—conditions which are not easy of explanation. Just above the "Bryozoa Bed" and exposed



THE AVON SECTION

in the footpath below the railway cutting, is a "palate bed" in which the teeth of selachian fishes are numerous.

The Lower Limestone Shales form a transitional series between the Old Red Sandstone and the massive Mountain Limestone, the lower beds of which (L.L.) are seen in the Black Rock Quarry beneath the sea walls of the Downs. The lowest beds are characterized by great numbers of *Spirifera striata*, while the succeeding strata are largely composed of crinoidal ossicles. Teeth and spines of selachian fishes have been found in these Lower Limestone strata belonging to some twenty species, of which eleven type specimens are preserved in the Bristol Museum.

Beyond the Black Rock Quarry is a path leading from the Downs above to the water-side, and at the foot of the gully there is, on its Bristol side, a small quarry in which the limestone is oolitic in structure. This band of oolite, which may be traced throughout the district, is of considerable service to the field geologist, who can use it as a means of determining the position of beds in a massive series of limestone in which "zoning" has at present not been carried far.* Above the "gully oolite," (G.O.), as it may be termed, follow shaley beds (M.S.) and thin-bedded limestones in which *Micheldeania* has been discovered, and for which, therefore, Mr. Edward Wethered has proposed the name "Micheldeania beds." Then come the more solid and massive upper limestones of the great quarry (U.L.). These are the "Middle limestones" of Mr. Wethered's classification. In these beds crinoidal ossicles are comparatively rare; *Spiriferæ* are replaced by *Terebratulæ* and *Producti*; species of the coral genus *Lithostrotion* are not uncommon; and the limestones are greyer, containing less of the bituminous matter which characterizes the lower strata and gives them a peculiar smell when freshly broken. There are also oolitic beds; and the whole series is characterized by foraminifera and other micro-organisms.

A little beyond the path which crosses the line near the

*Dr. Wheelton Hind is engaged on an investigation on this subject. See Geol. Mag. N.S., Decade iv., vol. v., pp. 61–69, Feb., 1898.

Clifton end of the great quarry, the limestones, again frequently oolitic, are interstratified with bands of grit and sandstone, indistinguishable in hand specimens from millstone grit, and layers of shale. Large *Producti*, masses of *Lithostrotion*, and beautiful specimens of *Lonsdalia* and *Cyathophyllum* are found in these Upper Limestone Shales (U.L.S.),* which are well exposed in the Bridge Valley Road leading down to the Hotwells Station, and which pass up into Millstone Grit (M.S.G.) on the western side of Observatory Hill. Here the uniform sequence of strata, which throughout the gorge dip at an angle of about 26° to the S.S.E., is broken by the Clifton Fault. Seldom has the geologist a better opportunity of seeing the direct effects of such a dislocation. The massive limestone of Observatory Hill has been thrust up over the contorted and torn beds of the Upper Limestone Shales, as may be clearly seen at the foot of the Bridge Valley Road, just where the line emerges from the tunnel outside Hotwells Station. A minor dislocation in the Limestone of the hill itself may be seen from the Somersetshire end of the Suspension Bridge. Between Observatory Hill and Windsor Terrace the Upper Limestone Shales are repeated on the Bristol or upthrow side of the great reversed fault which has a throw of some 1200 feet.

Turning now to the physical conditions which may be inferred from the sequence of strata thus briefly described, we find evidence that the Old Red Sandstone period was brought to a close by the invasion of the sea beneath the mud-laden waters of which the Lower Limestone Shales were deposited. The succeeding limestones tell of clearer water, at the bottom of which sea-lilies abounded and afforded food to the selachian fishes which crushed their stems with powerful teeth. Then followed the formation of the "gully oolite" in clear water but not deep, for weathered surfaces often disclose unmistakable evidence of current bedding. The researches of Mr. Edward Wethered show that many oolite grains are composed of tubules,

*The fossils described by Fort-Major Austen (1865) from the Millstone Grit were probably for the most part derived from the Upper Limestone Shales.

probably of organic origin and assigned to *Girvanella*. But it is by no means certain that oolitic structure is universally due to this vegetable organism. If, however, the "gully oolite" was formed through the agency of *Girvanella*, it must have abounded in countless numbers over a large area of the sea-bottom. Then followed times in which the water in the northern part of the district was more turbid, giving rise to shaley beds. The sea-lilies were unable to re-establish their ascendancy, and the fishes seem to have been reduced in numbers. But when the waters again cleared, *Lithostrotion* corals became numerous, and partly through their agency, partly through that of brachiopods and other organisms whose comminuted remains form a large proportion of the rock, the Upper Limestones, such as are now exposed in the Great Quarry, were slowly built. On this long period of limestone formation succeeded a time during which the physical conditions were transitional between those of clear water, and those of the shallowed sea, with its rapid currents, in which the Millstone Grit was formed. The sea was thus silted up and those very special and peculiar swamp conditions, under which the Coal Measures had their origin, were ushered in. The approximate thickness of the Lower Carboniferous series in the district is given in the following table :—

	Mendips. (Burrington Combe).	Clifton.	Wickwar.	Forest of Dean.
Upper Limestone Shales ...	not seen	400	300	115
Upper Limestones (including Micheldeania beds) ...	700	1000	530	400
Lower Limestones (including Gully Oolite) ...	1550	650	520	
Lower Limestone Shales	350	320	320	250

From this table it will be seen that there is a progressive thinning of the deposits as we pass from the Mendips, where the total thickness is fully 3,000 feet, to Wickwar, where there is little more than half that amount, and so northwards towards the land-area in Wales which formed part of the

margin of the Lower Carboniferous sea, where these beds thin out.

There is one local episode in the history of this period which should not remain unmentioned. Igneous rocks occur in the limestone on the coast near Weston-super-Mare, and further east near Woodspring Priory ; and also inland near Wrington Warren. These used to be regarded as intrusive. But a careful study of the beds at Middle Hope, near Woodspring, some three years ago, convinced me that they gave unmistakable evidence of contemporaneous volcanic action at a time slightly anterior to that at which the "gully oolite" was formed. This conclusion remained unpublished. And it is a satisfaction to me to learn from the recent survey publication that so competent a geologist as Mr. Strahan has quite independently reached the same conclusion. On Worle Hill, west of the camp, there are beds of volcanic ash. The Wrington beds are not well exposed, but I have found fragments of cemented ash containing small lava lapilli which leave no doubt in my mind that at this locality also we have evidence of contemporaneous volcanic action at nearly, if not quite, the same horizon.

Into the familiar story of the making of our coal seams I will not enter here. There is no evidence, so far as I am aware, that the sea ever gained access to our swamps and lagoons as it did in some parts of northern England. Nor will I attempt to decide whether all our coal seams were formed by the growth of the swamp vegetation *in situ*, or whether some were formed by the drift of vegetable *débris* into the lagoons to settle there as a stratified deposit of vegetable material. In either case we have a period of long-continued depression, during which thousands of feet of sandstones and shales with occasional coal seams were laid down. Indeed, when we take into consideration the whole series of strata from the Old Red Sandstone to the top of the Coal Measures, we have in our district some 11,000 feet of strata formed in water which was probably never 1,000 feet deep. Nothing could be clearer than the evidence of prolonged and gradual depression accompanied by the formation of layers of deposit, sometimes insufficient

in amount to keep pace with the subsidence, sometimes in excess of it and causing the shallowing of the water.

So far, the history of our district is one of comparative quiescence; of gradual depression and gentle sedimentation, diversified by volcanic episodes of no great intensity. None of the present physical features had then any existence. But this was not to continue indefinitely. The curtain, which falls on the first act of our geological drama, an act serving only to introduce some of the principal characters, rises on a different scene. The strata have been bent into arches and hollows, the sweeping curves of which they still retain. Caught in the strong embrace of straining earth-pressures they have been thrust up into ridges and domes with troughs and basins between. In the first act the agencies of denudation were busy elsewhere, behind the scenes, preparing the materials which played their part in the deposition we have witnessed; in the second act they come forward and take their share in the action of the drama.

From the close of Carboniferous times till the Triassic period had nearly run its course, our district was subject to sub-aerial denudation. To the north and to the south Permian deposits were in course of formation in inland seas or lakes. But no such strata are found near Bristol. To the north and to the south the later lakes of early Triassic or Bunter age were areas of accumulation. But still our district underwent denudation. During Keuper times the saline waters extended and crept over the land. But not till the salt-lake period was drawing to a close was the lower ground at length submerged. And even then the higher hills, which the prolonged denudation had been unable to wear away, stood out over the barren waters as an archipelago of islands, of which Mendip was the largest. And as the waters crept up their sides and occupied their valleys as salt creeks, the stones and boulders which lay upon their flanks formed, with cementing materials deposited by the lake, the massive deposit known as the Dolomitic Conglomerate.

No member of the British Association who has any

interest in such matters should fail to visit the exposure of this puzzling rock on the Bridge Valley road (*see Avon section D.C.*) He is standing in one of these boulder-filled creeks. When it was occupied by the Keuper waters the Avon Gorge had no existence. The hollowed sides of the creek are still traceable, rising on the one hand towards Durdham Down and on the other towards Observatory Hill. Eastwards, towards Cotham, lay the spreading salt-lake, westwards lay the head of the creek, and on the opposite or Somersetshire side of the present Avon Gorge may be seen the flat-lying deposits resting unconformably upon the older rock surface, and formed when the waters had crept yet further up the valley. Five minutes' inspection of the exposure by the roadside will give a better idea of the size of the boulders, their irregular distribution, and how they are embedded in fine-grained material than any words of mine. But more than twice five years of questioning have not enabled me to evolve a satisfactory answer which shall adequately explain the facts presented. Ice-action, the willing slave of geological speculation, suggests its aid. But there is no evidence of glacial striation here or elsewhere. Opposite Sea Mills is a fine exposure of beds of the same age resting unconformably on Old Red Sandstone. But the larger proportion of the blocks it contains are from the mountain limestone and must have travelled some distance. This so-called Dolomitic Conglomerate is so variable a deposit and takes its character so much from the nature of the rocks on or near which it was formed that students, who see it under such different guises, resent the application to all alike of this descriptive name. Often it is neither a conglomerate nor dolomitic. These marginal beds of the Triassic lake, if we may so call them, are not necessarily older than the marls and sandstones which were formed in the deeper parts of the lake. They were formed under special conditions as the waters crept up the flanks of the hills. In the marginal deposit on Durdham Down have been found reptilian remains of *Proterosaurus* and *Thecodontosaurus*.

Before leaving the strata of the Triassic lake with its red and green marls, and its remarkable marginal beds, passing mention should be made of the sheets of gypsum, and the tabular or irregular masses of celestine which were precipitated from its saline waters and subsequently crystallized. The latter forms a valuable economic product which is raised at Yate, Bitton and Winford, and is used for sugar-refining. The ochre or raddle deposits of the last-named locality are also of Triassic age.

Meanwhile important physiographic changes were taking place in Europe, and these were soon to make themselves felt in the neighbourhood of Bristol. While the waters of the Keuper lake were creeping up the slopes of the Mendip Isle and Durdham Downs, an extensive mediterranean sea was giving rise to contemporaneous marine strata in the region which now forms the Eastern Alps. There some 2,000 feet of Rhœtic strata follow the marine equivalents of the Keuper of Northern Europe. Slowly the waters of this southern sea stole northwards, until at last they invaded the English Keuper lake. And with them came marine reptiles, the *Icthyosaurus* and *Plesiosaurus*, and fishes such as *Hybodus*, *Saurichthys* and *Ceratodus*. The earliest immigrants would seem to have entered the lake before the saltness of the water was sufficiently reduced to form a suitable medium in which they could live. They died in thousands; and their bones and teeth form the remarkable bone-bed which marks the commencement of the Rhœtic deposits in our area, and which some of the members of the Association will have an opportunity of seeing at Aust Cliff on Severn, just opposite the mouth of the Wye. Here the red and green marls of the Trias give place to the black shales of the Rhœtic or Penarth beds in which are found the characteristic fossils *Cardium rhœticum*, *Pecten valoniensis*, and *Avicula contorta*. Mr. Edward Wilson has made a careful study of these beds at Pylle Hill, near the Bristol Joint Station. But as these Rhœtic strata shade upwards into the Lias they afford evidence of the manner in which the immigration of marine animals from the south-east

stocked this new Jurassic colony with a rich and varied fauna.

The few feet of transitional Rhœtics are but a meagre representative of the 2,000 feet in the Eastern Alps ; but it must not be supposed that the one is the contemporaneous representative of the whole of the other. There is very little doubt, in my opinion, that during most of the time during which the Alpine Rhœtics were in process of formation the neighbourhood of Bristol was still dry land and undergoing sub-aerial denudation. The Bristol Keuper deposits are the time equivalents of the later Rhœtics of the Alps ; and it was only when the Rhœtic period was just drawing to a close that marine organisms gained access to our area.

But with the deposition of the Secondary or Mœsozoic strata we have rung up the curtain on the third act of our geological drama. The first act is occupied with the formation of the Palæozoic strata, Silurian, Old Red Sandstone and Carboniferous. The second act is concerned with the uplift, under severe earth-pressures, of these rocks, with their ridging into arches and troughs, and with their early fashioning under the tools of denudation. It is in our third act that the carved surface is buried under newer Mœsozoic sedimentary deposits. First, the denuded low-lands were occupied by the waters of the Keuper lake ; these then crept up the sides of the hills and formed creeks in their valleys, until only an archipelago of islands broke the surface of the lake. Then the sea gained access and the Rhœtic beds were formed, in the waters around the sinking archipelago. As Lias times followed, the islands disappeared and were covered by deposits of this age, the lithological character of which—often a white or light-grey limestone of slightly crystalline texture—may well puzzle the geologist accustomed to the Lias of Lyme Regis or Whitby, till a *Pecten pollux* or other characteristic fossil reveals their true age. To the north-east of Durdham Downs, to the north of Chipping Sodbury, on Broadfield Down to the west of Dundry, near Shepton Mallet, and above the Harptree ridge on Mendip, to mention but a

few localities, Liassic strata rest unconformably upon Mountain Limestone without any intervening Trias or Rhœtic. Thus the archipelago sank, and only the upper part of the Mendip Isle remained above the water, not to be completely submerged till the Inferior Oolite times; even if then it had wholly disappeared beneath the Jurassic waters.

Owing to the diversity of the physical features of the sea in which they were deposited the Liassic strata vary much in volume and distribution. The Lower Lias reaches a thickness of between six and seven hundred feet at the foot of Leckhampton Hill. The Middle Lias is somewhat more than three hundred feet thick at Wotton-under-Edge and also at Bredon Hill, an outlier of the Cotteswold escarpment, where there are some 280 feet of Upper Lias. Mr. Topley gives a section from Leckhampton Hill to near Burford, on the borders of Oxfordshire, in which the total thickness of the Liassic strata is represented as gradually decreasing from 1000 feet at the former place to a tenth of that amount or less at Burford. Traced southwards along the foot of the Cotteswold escarpment the Middle and Upper Lias thin out and are nowhere well exposed. But yet further south in Glastonbury Tor there are fifty feet of Upper Lias and about 275 feet of Middle Lias. The Lower Lias near Bath may reach a thickness of 250 feet, but near Paulton it is reduced to but eighteen or twenty inches. Fuller information on the Liassic strata near Bath is given in the Rev. H. H. Winwood's excellent account of the Geology of that neighbourhood in the Association handbook of 1888. His careful work in that district and his association with Mr. Charles Moore, whose admirable investigations are well known to geologists, enable him to speak from long personal knowledge.

Between the Lias and the Inferior Oolite come the beds which have long been known as the Midford Sands, so called from the village of that name, near Bath, where they are well seen. Such names are of local value and indicate the physical conditions under which the deposits were formed. The succeeding Inferior Oolite forms the

higher part of Dundry Hill. Recent investigations of Messrs. S. S. Buckman and Edward Wilson suggest the advisability of regrouping all the lower Jurassic strata on palæontological grounds based mainly on the occurrence of Ammonites. Increasingly valuable as such "zoning" work must be, important as it undoubtedly is for the accurate classification of the beds and the determination of their order of sequence, it would be a misfortune to Geology were it wholly to withdraw our attention from the lithological characters of local deposits which enable us in some degree to construct the physical geography of the past. It is to be hoped, however, that a wise combination of both methods of enquiry will enable us better to understand both the sequence of life and the stages of its evolution on the one hand, and, on the other, the conditions of sedimentation in the ancient seas. Thus only can an adequate picture of the past be reconstructed. If, as Messrs. Buckman and Wilson suggest, the strata of Dundry Hill, from the local absence of some of the life-zones, afford evidence of local current denudation or temporary cessation of deposition, it enables us to realize some of the changes which went on in the shallow Jurassic sea of this period.

Bare mention must suffice of the succeeding Mœsozoic deposits. Fuller's-Earth, Great or Bath Oolite, Bradford Clay and Forest Marble, and Cornbrash are all found near Bath, and probably extended towards Bristol, serving to bury the whole district yet deeper beneath an overload of Secondary deposits. Whether the Oxford Clay and Coral Rag did so we do not know. Probably the Portland Oolites did not; and there was temporary denudation before Cretaceous Rocks completed the Mœsozoic series of the district. In any case the old land surface, sculptured by the earlier denudation, was buried beneath a Secondary series of strata in which are entombed the remains of a rich and varied marine fauna. Gradual depression afforded opportunities for the formation of alternating deposits of clay, more rarely of sandstone and of characteristic limestones which are often oolitic in

structure, often composed of coral and shell-*débris*,—occasionally, as at Murhill, in the Bath Oolite, full of polyzoan remains,—and are so frequently false-bedded as to indicate shallow water and swift currents, and hence irregularity of sequence ; so that the beds of the Inferior Oolite at either end of Dundry Hill and those of the Great Oolite on the hills round Bath differ in their arrangement and in the details of their succession. Zoning in the shifting deposits of such a current-swept sea must be carried out with great caution and circumspection.

Thus was the district submerged and strewn with secondary sediments, burying the old land-features ; and the curtain falls on the third act of our geological drama.

It is rung up on a different scene. With the beginning of Cainozoic or Tertiary times the whole district has been re-elevated to form dry land, and the second period of prolonged denudation is initiated. This final re-emergence must probably itself have been accompanied by marine denudation. It must be remembered that the uplift of the area from beneath the waters of the chalk sea was not sudden but gradual. As the oozy bottom was slowly raised to the surface it was played upon by the waves, which would readily erode the soft layers of recently-deposited and little-consolidated material. We may picture the battle of contending forces. Those of upheaval were striving by steady uplift to raise the sea-bottom into dry land. Those of marine denudation lashed with their waves the oozy deposits as they came to the surface. Layer after layer were lifted to the sea-level; layer after layer were swept away by the breakers. What eventually decided the struggle and gave to upheaval the final victory, it is impossible to say. It is not improbable that over the Mendips marine denudation, during the process of upheaval, held its own until the hard core of the old range was laid bare. Further north the Cotteswold escarpment may have formed a line of cliffs and prepared the way for the existing watershed. But these conclusions are largely conjectural. We know that the upheaval, then or somewhat later, took place in such a way as to give to the Mœsozoic

strata, and the old land surface on which they rested, a prevalent gentle easterly dip. And we have good reasons for concluding that the limestone ridges round Bristol were still covered by Secondary deposits when the district once more formed dry land. The beginnings of our present system of river-drainage were then outlined, and the fourth act of the drama exhibits the action of these denuding forces first on the Secondary rocks, then on the old pre-Mœsozoic land-surface, gradually laid bare; and lastly, on the ancient rocks thus exposed, which were trenched by new valleys cutting deeply through the old lines of hill.

The Severn and its tributaries, especially the Bristol Avon, play the leading parts. The depression in which the Severn now rolls its tidal waters is a very old physical feature. Great faults such as that which, near Cattybrook, has brought the Coal Measures against the more resisting Lower Carboniferous rocks, and those which disturb the strata near Portishead, forcing Old Red Sandstone and Pennant into juxtaposition (which involves a throw of fully 4000 feet), may have helped to outline its southern shore. Prolonged denudation scoured it out; and in Triassic times it seems to have formed an arm of the lake, narrowing westwards. On the re-elevation of the land in Tertiary times it began to be, what it now is, a dominant line of drainage, and poured its waters, as now, westwards into the Atlantic. Tributary streams bore down to its fuller flood the *débris* removed from the Secondary rocks, wearing them back to the escarpment which continues the line of the Cotteswolds southwards towards Bath, and leaving outliers (of which Dundry is a conspicuous example) standing out as hills of circumdenudation surrounded by the shrunken streams which have carried off the detritus from their weathered flanks.

If we endeavour to picture the scene when, in early Tertiary times, the tributaries of the Severn began their work of denudation, and when heavy rains swept the gentle slopes of their valleys, we see as yet no sign of the ridges of Mountain Limestone or Old Red Sandstone which now form such marked features of our immediate

landscape. The pre-Mœsozoic land-surface around Bristol was still buried beneath a gently undulating sheet of Secondary strata, in the hollows of which the streams had already established their course—a course thus necessarily wholly independent of the ancient physical features still enveloped in the sediments of the Secondary age. Unless we realize that the Avon and its tributary, the Trym, had their course determined long before the Downs emerged into view through subsequent denudation, it is quite impossible to understand how the Gorges of Clifton and Combe Dingle came into existence.

One may liken the effects of sub-aerial denudation to the concurrent action of two processes ; first, the file-like fretting of the streams in their beds ; and secondly, the wasting of the whole surface by means of the sand-paper action of rain and the crumbling disintegration of the weather. But the stream has a double office ; not only does it deepen its channel, but it bears seawards all that rain and the weather wear off the valley slopes. Where the rocks are soft and yielding the sand-paper and the file act at nearly equal rates ; the valley is wide with gentle slopes. Such were probably the conditions when the Avon and the Trym at length reached the level at which the backs of our Downs were just laid bare. As the concurrent action of the two denudation processes continued through long ages, the effects where the ancient ridges of old rocks slowly emerged, were different from those where pre-Mœsozoic sculpturing had already formed broad and open valleys in which the more yielding Trias marls and Lias clays still awaited removal. The action of the river-files was restricted to the rate at which they could cut through the harder rocks in the lower part of their course, for the erosion of the softer beds above was limited to the depth to which the notches in the harder strata were cut. And since the superficial waste, due to rain and weather, continued with unabated vigour over the more yielding area, the valleys here remained broad and open. But over the old ridges, whose existence was primarily due to their powers of resistance to an earlier superficial erosion, rain and weather had little

power. The action of the file outran that of the sand-paper, and the gorges of the Avon and the Trym resulted. They impress the eye from their narrow cleft-like form and their steep sides. But, gauged by the amount of material removed, they are characterized rather by defect than by excess of denudation. The quantity of sedimentary deposits swept away by the Avon during the formation of its striking gorge at Clifton is far inferior to that removed in an equal length of the river's course above Keynsham, where the valley widens out and has a much less impressive appearance.

Another example of the way in which the newer rivers cut defiles through the older ridges is seen near the northern boundary of the Gloucestershire coal-field. A range of Mountain Limestone upland here forms the containing rim of the basin in which the lower-lying Coal Measures lie. From Almondsbury through Tytherington, Cromhall, Wickwar, and so round to Chipping Sodbury, runs a tract of Mountain Limestone forming a horse-shoe ridge. Most of the drainage of the Coal Measure area is into the Frome which joins the Avon at Bristol. And one might naturally expect that the horse-shoe ridge would form the watershed of the whole of this drainage area. But this is not so; for within the limestone rim, south of Cromhall, there rises a small stream which, instead of joining the Frome drainage, makes northward for the ridge, breaches it in the well-wooded and picturesque gorge, which is one of the peculiar beauties of Lord Ducie's estate (in which it is artificially dammed to form ornamental lakes, the winter home of many wild fowl), and so joins the waters of the Little Avon which falls into the Severn near Berkeley. Mr. Etheridge believed that the gorge was a faulted line, but a careful examination of ground has convinced me that there are no dislocations of any importance. The defile is a denudation feature. When the river, whose drainage area has probably been materially decreased by the encroachment of the Frome basin, began to flow, the horse-shoe ridge was still buried beneath the Secondaries over which the stream took its northward way in accordance with the slope of the surface

as it then existed. And the gradual emergence of the old Limestone ridge could do nothing to divert its well-established course. But as the ridge was left outstanding by the sand-paper denudation of the surrounding country, the stream, ceaselessly fretting over its bed, filed down the deep gorge to delight the eye and to enforce a geological lesson.

And when we find that the same horse-shoe ridge is not only breached from within by an outward flowing stream, but is also cleft from the opposite direction by a tributary of the Frome, the lesson is yet further enforced. This is the case near Chipping Sodbury. On either side of the old British encampment of Old Sodbury two streamlets have their source within a mile of each other; one flows to the east, the other to the west. The former is a parent stream of the Bristol Avon; the latter, of its tributary, the Gloucestershire Frome. The easterly rill, mingling its waters with those of other streams, runs past Malmesbury, sweeps round by Chippenham, and flows in a bold curve through Trowbridge, Bradford, and Bath to Bristol, where it is joined by the waters of the other rill which have flowed through Chipping Sodbury, Yate and Stapleton. Not only, therefore, does the lesser stream cut through the Mountain Limestone ridge, but the longer river threads its way through the oolitic uplands round Bath, here cutting boldly through the range of hills on the easterly dip-slopes of which it had its birth not many miles further north.

When we remember the length of time that has elapsed since these streams began to flow, and since the later denudation of the district began to carve the surface into sculptured relief, we shall cease to wonder at the depth of its gorges and the broad sweep of its more open valleys. And when we realize how diverse are the rocks which have been exposed to these long-continued erosive influences, we shall understand how it is that the Bristol Avon and its tributaries have been instrumental in producing such varied and beautiful scenery. Nor must we forget that during the vicissitudes of a changing climate, and in consequence of variations of relative level in sea and land, denudation may

well have been often far more intense than it now is. The cliffs of the Avon Gorge did not always look down on a tidal mud-laden stream. There were once some hundreds of feet of descent between the present site of Cumberland Basin and the sea many miles distant. When the streams began to flow the climate was tropical, as the fossils of the Tertiary deposits of the London Basin show; a warm ocean current may have coursed through Asia to the Mediterranean and through the heart of Europe to the London Basin; and a tropical rainfall may have swept the valley slopes and swelled our streams. As Tertiary time elapsed this current was diverted, and the climate passed through successive phases of lowering mean temperature until the increasing cold culminated in the glacial epoch. Although there is no evidence of glaciers in our district, snow must have lain thickly on the hills in winter, and, when it melted, produced torrential floods. The small streams of to-day must often have been swollen to many times their present dimensions, and exerted a denuding influence far in excess of its present amount. Geological uniformity does not exclude wide differences in intensity of action. And when we look down from the slopes above Limpley Stoke on the Avon creeping sluggishly seawards, we must not suppose that such was the stream that carved the valley through the Oolitic hills; not such was the stream that swept down the large rounded masses of grit and limestone which are found in the Twerton gravels near Bath. No such stream as this could have produced the Avon Gorge at Clifton. The scenes of the geological drama stir our imagination with a display of activity more swift and forceful than is to be seen in the quiet life of to-day's sleepy hollows in Gloucester and Somerset.

Some further allusion may here be made to a geological feature which is particularly well illustrated in our district. I refer to the revelation by the later denudation of the sculptured surface which was produced in pre-Mœsozoic times before the area was invaded by the salt waters of the Keuper lake, or was smothered beneath later Secondary strata. It is, no doubt, impossible to

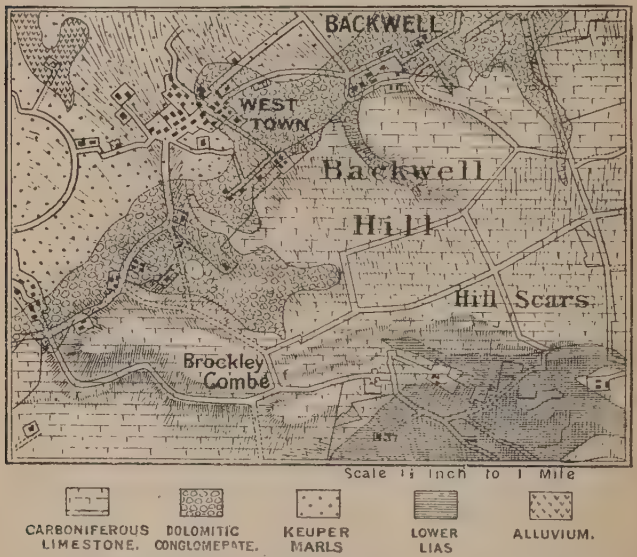
say for certain to what extent the ridges and valleys in the older Palæozoic rocks have been remodelled by the later erosion which has revealed their existence. Standing on Observatory Hill and looking northwards towards the Severn, the line of vision passes first over the shallow depression between Clifton and Durdham Downs. This is undoubtedly a pre-Mœsozoic feature, for it is filled with flat-lying Triassic strata. Beyond Durdham Down is seen the tree-clad ridge of Kings Weston Down. The one is the southern the other the northern limb of an arched dome of Mountain Limestone, the summit of which has been removed by denudation. Beneath what was once the middle of the arch at least fifteen hundred feet of Old Red Sandstone and two thousand feet of lower Carboniferous, to say nothing of probably six or seven thousand feet of Coal Measures, have been swept away. But in the basin of the Trym, where subaerial erosion formed a hollow in the area over which the dome once stretched, lie the horizontal Triassic beds, which tell us that all this erosion took place in pre-Mœsozoic times, and that the hollow is not a new but a very ancient physical feature. Turning towards the S.S.W., and looking out from Observatory Hill over Somersetshire, we see, on the Severn side of Dundry, the arched back of Broadfield Down, and, beyond, the more distant and more complex arch of Mendip. In the hollows between these arches stretches an eroded surface of Coal Measures. But over them lie horizontal Trias beds, which again tell us that these hollows are of pre-Mœsozoic date. These features at any rate are not the result of Tertiary erosion, which has not indeed sufficed to remove all the materials with which they were filled up in Secondary times. But what about the summits of the ridges? Have they been materially reduced in height by the later denudation? I believe not.

Turning northwards again, and looking across to Durdham Downs, we see how smoothly the dipping beds of Mountain Limestone have been shaved off to form a broad and nearly level surface. It has all the appearance of being part of a plane of marine denudation. Subaerial forces could not

have produced so flat and even a surface. It is probable therefore that the final planing of the ridges, paring them down, over a considerable area, to what must have been a surface of uniform elevation, was effected by the waves of the Jurassic Sea. On this planed surface, by further subsidence of the land, were deposited Liassic strata, such as are found resting unconformably on the eroded surface of the Mountain Limestone on Broadfield Down, and elsewhere. Wherever we see the relations of these sediments to the older rock surface on which they rest, we find that this surface is similar to, and continuous with, that of the planed-off ridges. On the back of Broadfield Down, for example, is a patch of Lias, which has escaped denudation. It is inconceivable that these Lias beds should have been preserved in their present position if the planed surface of the surrounding Down were the product of a far later denudation. And evidence of a similar kind is presented in such amount, and so well distributed throughout the district, as to justify the conclusion that the Mountain Limestone ridges, which form so marked a feature in our scenery to-day, are ancient denudation-features revealed by, and only to a small extent remodelled by, the later forces of erosion. And in further support of this conclusion we have the curious masses of Triassic, Rhætic, or Liassic *débris*, which have filled ancient fissures in the limestone They have been revealed by the quarrymen, who have left the economically worthless material standing out, like walls, in the quarry face. That at Holwell, near Nunney, is well known from the fact that from the infilling of the ancient fissure Mr. Charles Moore obtained the teeth of the little mammal *Microlestes*. Now it is inconceivable that these materials, dropped into open fissures in the sea-bed, could have been preserved for our study, if a later denudation had removed any considerable mass of the Holwell limestone.

The way in which we are able to reconstruct some of the physical features of the ancient land surface which the later erosion has revealed to us after so great a lapse of time, is peculiarly interesting. No doubt the uplands, before they

were planed down by the waves of the Jurassic sea, may have been higher and more rugged than they now appear. But since, as they sank beneath the waters of the Triassic lake, their valleys formed creeks in which were formed marginal deposits of a tough and resisting nature, the tongues of these rocks which run up into the limestone uplands, enable us to trace the old valley lines, and also to see their independence of the more recent gorges which have been formed during the later denudation. This is exemplified



in the accompanying cut enlarged from the Survey map, and representing the neighbourhood of Backwell on the northern slopes of the upland of Broadfield Down. It also introduces one of the patches of Lias which have been already referred to as resting on the broad back of the Downs. The manner in which the marginal deposits run up into the limestone along the lines of old creeks is clearly seen. And the comparative independence of the gorge of

Brockley Combe, the product of later denudation, is also evident.

Thus the close of the fourth act of the geological drama brings all the characters on the scene. The Palæozoic strata with whose introduction the action commenced stand forth in the curved lines which were impressed upon them by post-Carboniferous earth pressure, and with some of the still uneffaced features which were graven on them by the pre-Mœsozoic denudation. Around these lie the Secondary deposits the formation of which occupied our third act. And the whole uplifted surface has been recarved by the later denudation with which we have lately been concerned.

But a drama in four acts is an anomaly. And it only remains for me here to sketch the beginning of the fifth and concluding act when man appears upon the scene.

In our own immediate neighbourhood there are no abundant evidences of his advent as a rude Palæolithic hunter. But in Wiltshire, at Fisherton and Bemerton, roughly-chipped flint implements are found in gravels a hundred feet above the level of river bed of the Wily. The glacial epoch then probably still held northern Britain in the grip of ice. But in Wiltshire, Palæolithic man was not likely, according to Professor Boyd Dawkins, to suffer from want of game. "In Spring, Summer, and Autumn there were stags, bisons, uri, horses, pouched marmots, woolly rhinoceroses, and mammoths, and in the depth of winter, lemmings, reindeer, and musk sheep. Wild boars were in the woodlands, and hares in the glades. The hunter had, however, formidable beasts of prey, the lion and the spotted hyæna, as his competitors in the chase. In the spring time Fisherton was a nesting-place for the wild goose, and the heavy floods, rushing down the valley of the Wily at the break-up of winter, occasionally surprised the marmots before they awoke from their winter's sleep, and sometimes deposited their bodies in the sediment at the bottom of the river."

Such were the surrounding conditions under which the River Drift Palæoliths lived. Similar conditions must have

prevailed, in our own area, when their successors, the Cave men, ranged over the country. "We may picture to ourselves," says Prof. Boyd Dawkins, "a fertile plain occupying the Bristol Channel, and supporting herds of reindeer, horses, and bisons, many elephants and rhinoceroses, and now and then being traversed by a stray hippopotamus, which would afford abundant prey to the lions, bears, and hyænas inhabiting all the accessible caves, as well as to their great destroyer—man . . . . . Hyænas were the normal occupants of the caves (*e.g.* Wookey Hole) and thither they brought their prey. We can picture these animals pursuing elephants and rhinoceroses along the slopes of the Mendips, till they scared them into the precipitous ravine (Cheddar Gorge), or watching until the strength of a disabled bear or lion ebbed away sufficiently to allow of its being overcome by their cowardly strength. Man appeared from time to time on the scene, a miserable savage, armed with bow and spear and unacquainted with metals. Sometimes he took possession of the den and drove out the hyænas. He kindled his fires at the entrance to cook his food and to drive away wild animals; then he went away, and the hyænas came back to their own abode."

In an old quarry on Durdham Down, long since filled up, there was visible in 1842 a cave which was regarded by Mr. Stutchbury as a hyæna den. In it were found the remains of many animals, most of which are in the Bristol Museum, where is also preserved a model of the cave. The animals included the mammoth, straight-tusked elephant, hippopotamus, the woolly and the small-nosed rhinoceros, ox, deer, reindeer, horse, boar, hare, vole, lion, brown bear, cave bear, spotted hyæna, fox, wolf, badger, otter, and a member of the weasel family. No implements or other remains of man were found. But we are able to form a picture of the animals, his contemporaries, which then ranged over our downs.

Palæolithic men seem to have belonged to two distinct races, known as River Drift man, concerning whose racial affinities we are uncertain, though he is believed to have come from the South, and Cave man, who has been regarded

as allied to the Eskimos. In Kent's Cave, so carefully explored by Mr. Pengelly, the older implements associated with the remains of bears, are separated by a thick deposit of stalagmite, from the relics of Cave man. These consist not only of lance-heads, trimmed flakes, scrapers and borers, but also of bone awls, needles, scoops of reindeer antler and barbed harpoons. The associated animals in Kent's Cave are those (of which a list has been given) which were found in the Durdham Down cave, with some others such as the sabre-toothed tiger and the glutton. England was still continental and these animals could migrate freely from the south and east along the water-shed which separated the great drainage area of the Rhine and Thames, and that of the Channel river which received the Seine as an affluent. The cave-shelter at Wookey in Mendip has yielded the implements and tools of this later Palæolith as well as the bones of the animals of which he was the contemporary.

In England there was a considerable break in time between the Palæolithic and the succeeding Neolithic occupation. Great Britain had become insular, and the Neolithic farmers and herdsmen must have crossed the channel to reach our shores. They mined for flint, and often, but by no means always, ground and polished the surface of their implements. They introduced the stocks of the more important domestic animals, such as the dog, horse, sheep, goat short-horned cattle, and hog, as well as many cultivated seeds and fruits. These members of an Iberian race, allied to the Basques of the Pyrenees, are the ancestors of such tribes as the Silures of South Wales, who were driven to the mountain fastnesses by the Celtic Bronze folk, the early pioneers of the Aryan invasions of Britain. But the geologist is only concerned with the opening scenes of this concluding act of the drama and leaves the archæologist and the historian to bring the action up to the present time.

PRE-HISTORIC ARCHÆOLOGY.

By C. LLOYD MORGAN and ARTHUR BULLEID.

THE pre-historic remains in the neighbourhood of Bristol may be grouped as follows:—(1,) Megalithic Stone Circles; (2,) Dolmens; (3,) Long Barrows; (4,) Round Barrows; (5,) British Camps; (6,) The Wansdyke; (7,) The Glastonbury Lake Village. The exigencies of space preclude more than brief notes on these antiquarian relics.

1.—*Megalithic Stone Circles.* At Stanton Drew, near Pensford, some 6½ miles S. by E. of Bristol, there is a group of three stone circles whose erection is popularly ascribed to the Druids. The larger of the three, known as the Great Circle, is 368 feet in diameter, and seems to have been originally constituted by about thirty somewhat unevenly spaced rude and unhewn megaliths, some of which still stand, others have fallen, yet others are buried and invisible, while some are probably missing. The majority of the visible stones are composed of a hard silicified breccia, of "Dolomitic Conglomerate" age, and were in all probability transported by the circle-builders from Harptree Ridge on the fringe of the Mendips about six miles distant. Here similar weathered blocks still lie on the slopes of the hill. Other materials were however used. Two of the smaller stones are of sandstone, the source of which is doubtful, two of oolite, probably from Dundry, and one of comparatively unaltered breccia ("Dolomitic Conglomerate") also from Harptree Ridge. A short "avenue" of stones in parallel lines leads out from the Great Circle towards the E.N.E.

Near the Great Circle is a smaller ring known, from its position, as the North-East Circle. It has a diameter of 97 feet, and is constituted by eight large and massive blocks of silicified breccia, one of which must weigh some thirty tons. From this circle, too, there runs a short "avenue" bearing a little south of E., in which one stone is of oolite.

The third circle lies at a distance of 237 yards to the S.W.,

has a diameter of 145 feet, and is constituted by twelve smaller stones, most of them of the same silicified rock, but with one of but slightly altered Dolomitic Conglomerate, and one of sandstone.

Near Stanton Drew Church, about 180 feet to the W. by N. of the third circle is a dolmen ("The Cove") composed of the relatively unaltered breccia, one of the uprights of which is 10¼ feet high, 7¼ feet broad, and 2 feet thick.

A large recumbent sandstone megalith ("The Quoit") lies near the road at a distance of 618 yards to the N.E. of the Great Circle; and two smaller oolitic stones lie 1100 yards N. by E. of that circle, in a field known as the Middle Ham.

That the dolmen and these outlying stones form part of a definite scheme of construction seems probable from the facts that, according to the careful survey of Mr. C. W. Dymond, F.S.A., (1,) the quoit, the centre of the Great Circle, and that of the S.W. Circle are almost precisely in the same straight line; (2,) the cove, the centre of the Great Circle and that of the N.E. Circle are again in almost precisely a straight line; and (3,) the bearing of the cove from the centre of the S.W. Circle is very nearly the same as that of the Middle Ham stones from that of the Great Circle. These can scarcely be regarded as mere coincidences.

The megalithic remains are undoubtedly very ancient, but opinions differ as to the race by whom they were placed in their present position. By some they are regarded as the work of the Neolithic Iberian folk who were in possession of England before the Celtic incursion. By others they are ascribed to these later Aryan invaders. I incline to the former view. But their erection was probably gradual; and the circles may not have been completed before the later race had reached the neighbourhood of Stanton Drew.

As to their purpose, by some they are regarded as temples. Others look upon them as burial places. Perhaps they were erected stone by stone in memory of great warriors and tribal chiefs.

An exhaustive account of these circles will be found in Mr. C. W. Dymond's recently-published memoir on the Ancient Remains of Stanton Drew (1896).

2.—*Dolmens.* There are several dolmens in the neighbourhood. One at Wick lies eight miles to the east of Bristol. The remains of that at Druid Stoke is within an easy walk across Durdham Downs. The "Cove" at Stanton Drew has already been mentioned, and its probable connection with the scheme of construction there has been alluded to. The remains of a fine dolmen on Broadfield Down have recently been described and figured by the present writer in the Proceedings of the Clifton Antiquarian Club (1897). The three uprights are composed of hard grey Lias limestone from the immediate neighbourhood. The large irregular cover-stone, having a volume not far short of 100 cubic feet and a weight of between six and seven tons, is composed of silicified breccia, similar to that of the Stanton Drew stones, and was most likely brought from Harptree Ridge, more than six miles distant. It is probable that these dolmens were the work of the Neolithic Iberian folk. But if the Celtic Bronze-folk followed the traditional procedure of their precursors, the age of the dolmens may be assignable to the Bronze period. The bearing of the Stanton Drew circles, 6¼ miles distant, from the dolmen is S. 85° E.; that of the centre of the Great Circle from the Middle Ham stones S. 83¼° E.; so that these three are very nearly in the same straight line, which may be a coincidence, but, on the other hand, may indicate that the circles and the dolmen are connected in a single scheme of construction. None of the stones in the circles or dolmens bear any marks of the tool. They were presumably found lying on the slopes of the hills, and were conveyed by rude mechanical means to their present position and erected as unhewn monuments.

3.—*Long Barrows.* About two miles to the south-east of the Waterstone dolmen on Broadfield Down are the remains of a long barrow near Butcombe; and there is a well, preserved chambered tumulus at Stoney Littleton, near Wellow. These are also ascribed to the Neolithic Iberian race. They were used for purposes of interment; and it seems to have been customary to bury, with the chief for whom the tumulus was made, the remains of some of his

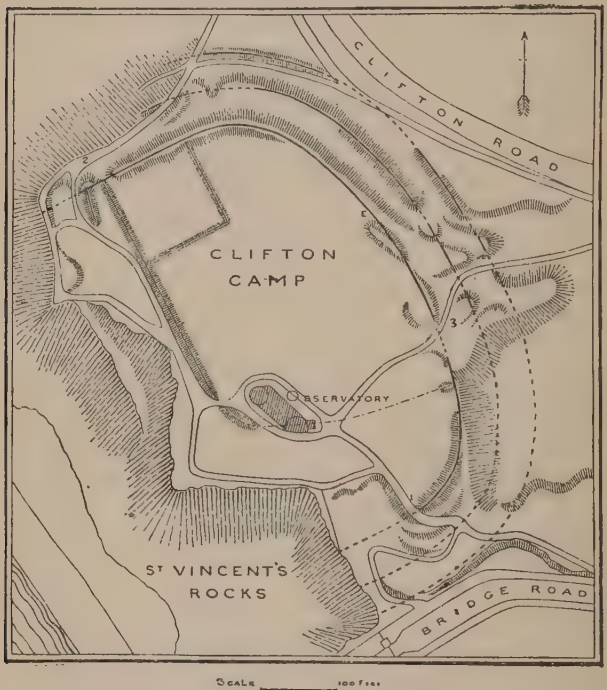
followers who may have been sacrificed, or may have fallen in fight in support of their leader. Two skulls which were found in the Stoney Littleton tumulus, and which have been described by Dr. Beddoe, seem to have been those of such retainers. One is that of a man, the other that of a woman. Both are of the long-headed or dolichocephalic type, and that of the man has strong brow-ridges and "forehead villainously low."

4.—*Round Barrows.* Round barrows dot the Mendip uplands, and are ascribed to the Celtic race who gradually dispossessed the Neolithic folk of the more fertile parts of the country, driving them to the mountains. Sometimes the dead were buried in a crouching attitude: more frequently, in the south of England, they were cremated and the remains enclosed in urns of earthenware. The latter method bears to the former the proportion of three to one in Wiltshire, and a yet higher ratio in Dorset. Implements of flint, delicately fashioned, and of bronze, together with ornaments of bone glass and amber, pottery and drinking cups, were buried with the dead or thrown into the fire during cremation. In some cases feasts were held on the funeral mound, after which additions of earth were made to the barrow, "each feast being represented by a layer of broken and burnt bones of the short-horned ox, horse, sheep or goat, and hog, together with charcoal."

5.—*British Camps.* There are several good examples of British Camps in the neighbourhood of Bristol. The Clifton Camp on Observatory Hill, and the Stokeleigh Camp on the opposite side of the Avon, are within such easy distance of our place of meeting that plans of them, modified, and in the case of the Stokeleigh Camp reduced, from the 25-inch Survey map, have been prepared under my directions by Mr. Arthur Singleton for insertion here. There was a third camp—known as the Burgh Walls (or Burwalls)—on the Somersetshire side of the river; but, except for a small portion in Mr. George Wills's grounds, and an indication of its northerly end where it abutted on Nightingale Valley, it has been destroyed.

The Clifton Camp has been much defaced by quarrying

and the construction of modern paths; but enough remains to enable us, with the aid of old plans, to reconstruct its



original outline. There are three paths by which the camp may be approached. None of them perhaps represents the original entrance. The first is from the direction of the Suspension Bridge (marked 1 on the plan); the second from the direction of Durdham Downs (2); and the third from the Clifton Road (3). Selecting the last-named, we see, as we ascend towards the camp, several irregularly disposed ridges and hollows which are for the most part the results of recent operations. On reaching the comparatively level ground of the enclosure and turning to the left (southwards)

the line of the inner vallum may be traced along the edge of a quarry by which the other two have been destroyed. All three ramparts were probably carried originally to the precipitous slopes of the Avon Gorge, which formed the natural boundary of the west or river side of the camp and therefore stood in no need of artificial defences.

Returning to our starting point and tracing the inner vallum to the right, northwards of the path from Clifton Road, we find at a distance of some 60 paces from this path the probable position of the original entrance (marked E on the plan), though its relations to the middle and to the outer vallum cannot now be traced, owing to the more recent disfigurement of the ground. This is about the position assigned to the entrance in William Barrett's plan of 1789, in which it is figured as running out in a straight line through the ramparts. Beyond this the inner and the middle vallum, with the fosse between, are clearly traceable for some distance, beyond which the latter has been defaced. The outer rampart is indicated in several places, and forms the outer boundary of a modern path. All three ramparts were presumably carried on so as to end off near the top of the steep slopes which descend towards the Avon, but owing to the contour of the ground not all abreast.

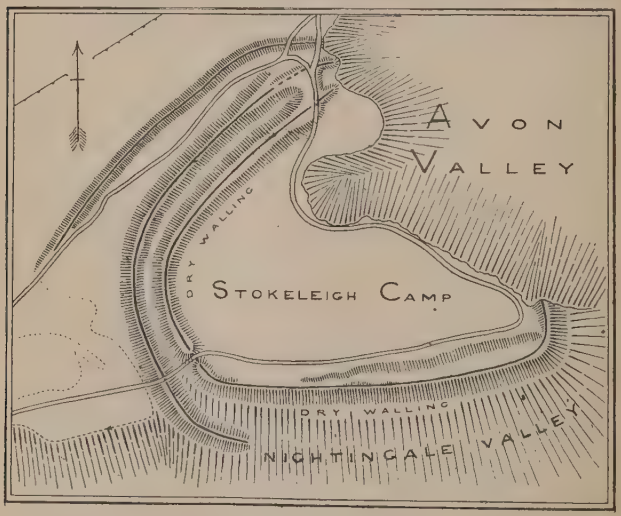
Within the enclosure (which has an area of nearly 4½ acres) there runs southwards a low ridge, roughly parallel with the natural boundary of the old camp. It ends off with a rounded angle near the Observatory house, and probably continued in a direction indicated by a dot-and-dash line on the plan, its point of junction with the inner vallum being faintly indicated on the ground by a spur-like mound. This inner enclosure has been by some regarded as Roman work, with which the minor square shown on the plan was connected; but for this view there does not seem to be sufficiently convincing evidence.

At several places along the inner vallum of the British work there are indications of a mortar-like material. This has been considered by some observers to afford evidence that mortar was used in the construction of the rampart. A more probable view is that camp fires were lighted along its

summit, and caused some of the limestone to be burnt to lime, which, when slaked by the rain, ran into the crevices between the stones. I am informed that during the destruction of the Burgh Walls ramparts the irregular and patchy distribution of the "mortar" favoured this view. Had the material consisted of sandstone instead of limestone, the result, on this view, would have been a "vitrified fort" like those found in Scotland.

In the plan the traceable remains of the ramparts are indicated by a firm line, their probable continuation where they are now effaced, by dotted lines. A finer line continued by dot-and-dash, shows the supposed Roman work.

The ramparts of the Stokeleigh Camp (which covers an area of rather more than 7½ acres) are more impressive, though the fact that they are now overgrown by trees prevents their being well seen except at close quarters. Their distribution is indicated on the accompanying plan,



which is drawn on a smaller scale than that representing the Clifton Camp. Of the three sections into which the

boundaries of the camp may be divided, that to the N.E. overlooking the Avon Valley is flanked by precipitous natural cliffs and needed no artificial defence. Here therefore there are no ramparts. That to the south overlooks the steep slopes of Nightingale Valley. Here there is a single rampart, now of no great height but showing here and there evidence of dry-walling, a method of building in all probability adopted in all those camps in our district where the ramparts were formed of stonework. It is very clearly seen in Dolbury on Mendip and in Worlebury, near Weston-super-Mare. The walling in the latter camp has been carefully described and figured in Messrs. Dymond and Tomkins' memoir on "Worlebury: an ancient stronghold in the County of Somerset" (1886). To the east of the southern boundary of the Stokeleigh Camp a natural feature may have formed a second line of defence but does not seem to have been artificially strengthened. At its western end the rampart is larger, and is flanked by an outer vallum descending the valley slope for some little distance.

It is on its north-western side, where the ground is level, that the camp was most open to attack; and we find this quarter most strongly defended by two large and massive ramparts, the inner of which even now rises in places 30 feet above the bottom of the fosse. This inner defence shows at the summit clear evidence of dry-walling, the stones being laid in line; but no mortar is visible. To the north both ramparts end off where the steep declivities towards the Avon commence. And from this end of the camp a third ridge, somewhat sinuous and diverging gradually from the others, is traceable for some distance. It has been suggested that this may have been originally connected with the Wansdyke. The original entrance may have been to the north.

A spur of ground runs out eastwards at the N. end of the encampment and shows some, but not very definite, signs of a protective rampart. Here, too, there are some indications of building in a small, partially divided parallelogram. This may be ancient; but I am more disposed to regard it as the foundations of a more recent hut, shed, or cottage.

To the S. of the spur is a depression running down to the

Avon side. This may have been an entrance to the camp, connected with a ford at the foot of the British trackway which ran down to the river on the Gloucester side.

At the S.E. corner of the camp the ground is somewhat raised. There may have been a look-out here.

There are several other good camps within easy reach of Bristol; but their description would take us too far afield. They are ascribed to the British (Belgæ), but how far back they date it is difficult or impossible to say. The walled camps may be of different age from the mound camps, but, if so, whether they are older or later we do not know. Some of the camps, such as Maes Knoll and Stantonbury, are on the line of the Wansdyke. And since the post-Roman date of this earthwork has been rendered probable it becomes at least possible that these camps are also post-Roman. They were probably not continuously occupied as fortifications but were strongholds into which cattle could be driven in times of raid.

6.—*The Wansdyke.* This irregular earthwork starts from the eastern extremity of Dundry Hill, where a huge rampart converts the end of the Dundry ridge into Maes Knoll Camp. Northwards and westwards of this it has not been clearly traced, unless the outer ridge at Stokeleigh Camp be regarded as part of the earthwork. But southwards and eastwards it runs, with varying height, and sometimes rendered discontinuous by long gaps, past Stantonbury Camp, by Englishcombe near Bath, over Claverton down, across the chalk downs north of Devizes towards Marlborough (at no great distance from Avebury and Silbury Hill) and so into Savernake Forest. It seems to bear a definite relation to Stantonbury Camp, where it has recently been suggested that excavations should be made with a view to obtaining further evidence as to its age. The ditch is always on its northern side. While its general direction is, as a rule, fairly well defined, its course in detail is often strangely irregular. North of Devizes its position and direction coincide for some distance with that of the Roman Road; and this is held by some to afford evidence of its post-Roman date. The excavations of General Pitt-Rivers

at Brown's Barn, near St. Ann's Hill, disclosed fragments of red Samian pottery on the old surface line, and in the body of the main rampart 6·2 feet, 3·2 feet and 6·3 feet respectively beneath the upper surface of the rampart. An iron cleat, or sandal fastener, was also found on the old surface line 7·9 feet beneath the crest of the rampart. These finds leave no doubt in General Pitt-Rivers's mind that the Wansdyke, like Bokerly Dyke, is post-Roman.

The more marked character of the earthwork on the hills and its absence in the valleys may be due to the fact that in the latter positions it was replaced by a stockade fence.

As to its purpose, it is scarcely probable that any tribe could have held so long a stretch of earthwork against an enemy. General Pitt-Rivers suggested tentatively, that Bokerly Dyke and Grim's Dyke might have been thrown up for the purpose of driving deer and other animals into the forest of Cranborne Chase, like the game-drives of the Red Indians (Beothuks) of Newfoundland. These were long fences of wood and branches of trees, erected for the purpose of arresting the migrations of cariboo and directing them to places where they could be conveniently slaughtered. One of these was traced across country for forty miles. It may be that the Wansdyke was erected for some such purpose. Perhaps the most probable view is that the earthwork served as a tribal cattle boundary, in which case there was most likely a stockade fence along the ridge crest. General Pitt-Rivers bids us bear in mind that there is nothing in the evidence at our disposal to disprove the supposition that the Wansdyke was thrown up by the West Saxons as a defence against the Mercians, or a boundary between their territories. "The frontier between Wessex and Mercia appears," he says, "constantly to have been shifting, but the line of the Wansdyke represents more or less the ordinary boundary that existed between these two tribes."

7.—*The Glastonbury Lake Village.* Mr. Arthur Bulleid, whose careful work is well-known to members of the British Association, has supplied the following account of these important pre-historic remains, and of the conditions under which their site was selected.

Lake Dwellings.

Man has from the earliest times utilized water to surround and protect his habitation. At first he availed himself of the natural advantages of the country, and erected his dwelling in a lake or mere, but as he became more civilized he found protection in moated castle and house. In Europe lake dwellings were constructed by Neolithic man, as well as by the people of succeeding ages, and at the present day huts of similar construction are still to be seen inhabited at Tapuseli, New Guinea, and in other parts of the world. Speaking generally, lacustrine settlements are of two kinds, the construction raised above the water on piles, and the crannog or artificial island. Those found in the British Isles are of the latter type, and include the Glastonbury lake or marsh village, which has been undergoing a systematic exploration since 1892. In giving some account of this, it is necessary to briefly consider the surrounding moorland in which it lies.

The levels of central Somerset are divided by a range of hills into the Parrett and Brue districts, the lower part of the latter area represents roughly a tract of land fourteen miles long by two to four wide. Throughout this there is a continuous layer of peat varying from a few feet to 22 in depth. What was the original extent of this at one time vast morass it is now difficult to say, as it appears to have extended beyond the present coast line. The upper or more inland portion of this peat district was occupied two thousand years ago by a series of reedy and shallow meres; as permanent areas of water these have long since ceased to exist, although a few much reduced in size remained until a comparatively recent date. It was near the edge of one of the smaller sheets of water that the Glastonbury crannog was constructed, but the site is now rich pasture land, and lies midway between the rising grounds of Glastonbury and Godney.

Before the field was disturbed by digging, the village consisted of some 65 low mounds, grouped with no definite arrangement and distributed over a space of about $3\frac{1}{2}$ acres. The foundation of the village consists of a substructure of timber and brushwood resting on the peat, which was

raised above the level of the mere water and surrounded by a stockade. On the surface of the woodwork, circular areas of clay were placed wherever a dwelling was needed. The village probably began with a few dwellings, but on account of part of the site being still unexplored, the exact number of original dwellings or groups of dwellings has not yet been determined. As the inhabitants increased, alterations of outline took place from time to time in the primary groups by the extension of the palisading, the filling up of the spaces so enclosed, and the subsequent erection of new dwellings, so that the various groups of dwellings ultimately joined to form one settlement.

The dwellings were, as a rule, circular and about eighteen feet in diameter, with walls constructed of vertical posts placed twelve to fifteen inches apart, the spaces between being filled in with wattle and daub. The clay floors were usually covered with planking, a space being left near the centre for the hearth, which consisted either of baked clay or a few slabs of stone. The entrances and doorsteps have been traced in many of the dwellings. The walls were about six feet high, and the roofs were probably thatched with reed and supported at or near the centre by an upright post. The stockade round the village was composed of piles from three to nine inches in diameter, forming a continuous line along its margin, near the east edge a landing stage was discovered, and leading from this to the village border a causeway made of stone and clay.

The Glastonbury marsh village is of more than ordinary interest, from the fact that it was inhabited during a well defined period immediately antecedent to the Roman occupation of Britain, or at least before the Roman power had reached so far west as Somerset. The relics discovered throw considerable light on the life and civilization of the people, and show they were skilled in carpentry, that they used the lathe and were able to turn a tub twelve inches in diameter. With the adze and bill-hook they cut the timber for their boats, wheels and looms; and with iron knives, gouges, and saws they made cups, ladles, and many smaller articles of wood. Thread was made with whorls of

lead and stone, and needles of bone and bronze were used for sewing. They manufactured both wheel and hand-made pottery in great quantity, and ornamented it with a profusion of incised designs of late Celtic type. They wore rings and bracelets of bronze, and decorated their person with beads of amber, jet, and glass; they used tweezers and mirrors of bronze and pigments of different colours. Metal working was carried on at more than one spot in the village, crucibles with the bronze slag still adhering, and the remains of tuyeres imply smelting; lead and iron were also worked, but the latter was probably imported. The inhabitants grew wheat and peas in the adjoining high lands, and reaped with iron sickles. They had horses and dogs, and kept cattle, sheep, and pigs. The roe and red deer were also killed for food, and fish and wild fowl were abundant. Besides the implements of wood and metal, more than 500 pieces of worked horn and bone have been dug up in or around the dwellings, these include combs for weaving, handles of knives and weapons, hammer heads and dice. Among the many other finds are objects of baked and unbaked clay, Kimmeridge shale, flint and stone. The human remains are interesting, and include several complete and remarkably well preserved dolichocephalic skulls.

This is but a brief and limited description of the settlement, and of the numerous objects found, many of which may be seen in the Glastonbury Museum, but a large number have not yet been exhibited from want of space and time for preparation.

BRISTOL AND ITS NEIGHBOURHOOD IN ROMAN TIMES.

By A. T. MARTIN, M.A., F.S.A.

THE counties of Gloucester and Somerset are peculiarly rich in remains which testify to a long and settled occupation by the Romans of this part of the country, but there is no direct evidence to show that the site of the City of Bristol was occupied either by a British settlement or by a Roman city. Many writers, it is true, whose critical faculty appears to have been obscured by their desire to magnify the antiquity of this famous city, have claimed for it either a British or a Roman origin. But these claims appear to rest only upon the conjectural identification of the name with the Kair Brito of Nennius. This evidence may therefore be rejected as wholly insufficient. Moreover, the entire absence of Roman architectural remains within the ancient boundaries of the City affords evidence, which, though of a negative kind, is irresistibly strong against the existence of a Roman city on this site. Coins and some other objects have, it is true, been found, but no excavations have as yet revealed either a single *tessera* or even a Roman tile. The site, moreover, at the marshy junction of the Frome and the Avon, was not especially calculated to attract the attention of the Romans, who at an early date appear to have occupied many points on the higher ground in the locality.

Unless, therefore, further building operations should reveal the now most improbable existence of Roman work, the origin of the city of Bristol must be ascribed to a period at any rate subsequent to the conquest by the Saxons.

But if the area within the city walls contains little of interest to the student of this period, the immediate locality abounds in remains of ancient roads and camps, and of relics of the Roman occupation.

At the beginning of our era the country to the north of the Avon was occupied by a Brythonic tribe called the Boduni or Dobunni. To the south of the Avon were the

Belgæ, another Brythonic tribe, who were closely allied to the Belgæ of Gaul. The Boduni were doubtless less civilized than their neighbours the Belgæ, owing to their greater distance from Gaul and the Continent, but they possessed a coinage of their own which is ascribed to the first century of our era. On some of these coins appears the name Bodvoc, which may be connected with the tribal name, and on others Antedrigus, who was possibly a chieftain of the Eceni. If this is the case we may conjecture that he had been driven from his country by an opposing faction, and had organised among the western tribes resistance to the Roman arms.

In the reign of Claudius the Boduni appear to have been subject to the Catuvellauni, their neighbours on the north-east, and when the conquest of Britain was begun in earnest, the defeat of Caratacus and Togodumnus, the sons of Cunobelinus, by Aulus Plautius, in A.D. 43, implied the subjugation of Gloucestershire. A camp at Gloucester, afterwards a "Colonia," was doubtless the base for the expeditions against the Silures west of the Severn. Their subjugation was completed by A.D. 75, and the interesting remains at Caerleon, the headquarters of the Second Legion, and Caerwent, still testify to the strength and durability of Roman work. Many of the British camps near Bristol appear to have been occupied by the Romans. Besides these, there are others which appear to be Roman in their origin, *e.g.*, Kingsweston near Blaise Castle, Bitton, Sodbury on the eastern ridge of the Cotswolds, and North Stoke.

The country near Bristol was thus among the first to be occupied and administered by the Romans; and Cirencester and Gloucester were both Roman cities before the end of the first century. Bath, too, must have been known as a health resort at this period; for among other very interesting remains found in this city, there is at least one inscription dating from the first century. Another inscription of the second century records that even at that early date the temple of Sul Minerva had fallen into ruin and had been restored. The ruins of the Roman baths in this city are among the most interesting in England.

One great Roman road, the xivth Iter of the Antonine Itinerary, must have passed close to Bristol. This road connected Caerleon and Caerwent in Monmouthshire, with Bath and Silchester. Proceeding westward from Bath, it seems to have passed through Bitton and Hanham, where a portion of the high road was long known as the "Auguste" Causeway. There is reason to think that it then made for the high ground to the north of Bristol at Ashley Down; and its course, as it skirted the marshy ground near the Frome, may be possibly indicated by an interesting Roman interment in a leaden coffin, discovered near Baptist Mills, in 1889. The exact place where this road crossed the Severn is a matter of controversy, but there are reasons for supposing that the crossing may have been from the mouth of the Trym, at Sea Mills, to Caldecott Pill, near Caerwent. In this case the road would have passed from Ashley Down to Redland, and crossed Durdham Downs from St. John's Schools to Pitch-and-Pay. The Reservoir now stands on the site of an undoubtedly ancient road of which an interesting piece still remains. This shows traces of the foss on each side, and corresponds with the dimensions of a Roman military road. At Sea Mills many remains of Roman buildings were discovered in making the dock in 1712, and since that time tesseræ, coins, fibulæ, and other relics of Roman occupation have been constantly discovered. The most important find was, however, a sepulchral stone inscribed "Spes C. Senti," which was discovered in 1873, in the garden of a house on the summit of the hill to the south of the Trym. A rude face is cut at the apex of this stone, and right and left are respectively the figures of a cock and a dog. Above the face is a star of five points. "Spes" appears to have been either the real or pet name of a wife or daughter of Caius Sentius, and there is no reason to assign a Christian origin to the stone. The lower half of the stone is, unfortunately, lost. This interesting find is now in the Bristol Museum.

Of other roads there are many indications, the most important being the one connecting the camps on the hills overlooking the Severn; this, proceeding from Kingsweston

and Henbury, followed the line of Cribb's Causeway and joined the Ridgeway at Almondsbury. It is possibly British in origin. From the junction at Almondsbury another ancient road called the Patchway led southward through Patchway and Fishponds in the direction of Horfield and Bristol.

On the low land between the Severn and the hills running from Kingsweston to Almondsbury, there are indications of ancient banks which have been called Roman roads, but they are more probably remains of works made by the Romans to reclaim this part of the country from the inroads of the Severn. Similar works have been traced in the marshy lands near Yatton.

The only villa close to Bristol seems to be one which occupied the site of Manilla Hall, in Clifton. Of this all traces have, unfortunately, disappeared. Within a radius of ten miles many other villas have been discovered, but accurate records of the plan or of the pavements, as a rule, are wanting. At Tockington Park, near Patchway, excavations were, however, carefully and systematically conducted in 1887 and 1888, under the auspices of the Bristol and Gloucestershire Archæological Society. This villa appears to date from the first century, and affords therefore additional evidence of the early settlement and pacification of this part of the country.

Finds of coins have been made in so many places that it is impossible to record them all: but while the beds of the Frome and the Avon and the hills of Ashley, Kingsdown and Clifton have all furnished their share, comparatively few have been found within the ancient walls of Bristol. Among other objects of interest that have been discovered from time to time particular mention should be made of two pigs of lead discovered without the walls in Wade Street, in or near to the old bed of the Frome. One of these is now in the Museum, and bears the inscription "IMP CAESA[R ANTON]INI AVG PII. P. P." These may either have come from the mines on the Mendips, which were doubtless worked before the Roman conquest, and were, as early as the reign of Vespasian, under Roman control, or possibly

from some mines at Pen Park, near Filton, where there are indications of ancient workings. The Museum also contains a fine bronze dagger and flint arrow-heads, from a barrow near Camerton, together with fibulæ, rings and other articles of domestic use, found near the same town ; Samian ware from Aust and Lundy Island ; Romano-British pottery from Lawrence Weston and Priddy on the Mendips ; and a particularly well-preserved bronze torque of late Celtic work, found near Wraxall in Somerset. A very fine collection of fibulæ and other objects from the Roman mines at Charterhouse Mendip is in private hands.

It has been said that this district was among the first to be conquered by the Romans ; it was also one of the last in the south of England to withstand the invasions of the Saxons. It was not till the year A.D. 577 that the victory at Dyrham, near Badminton, opened the way for the conquest by the Saxons of Gloucestershire and Somerset. Caerleon in Monmouth and South Cadbury in Somerset appear to be the Caerleon and Camelot of Arthurian legend, and the district between these two sites is invested with peculiar interest as being the scene not only of the legendary exploits of Arthur and his knights, but also of the more real feats of arms by which its inhabitants, whether under Arthur or some other leader, successfully withstood for nearly a hundred years the advancing wave of Saxon conquest.

MODERN HISTORY OF BRISTOL.

By JOHN LATIMER.

THE history of Bristol in the early Anglo-Saxon period is imperfect and obscure. Leland asserts, apparently on the authority of some monastic manuscript, that St. Jordan, one of the companions of St. Augustine, who landed in England in 596, was buried in what is now called College Green ; and later writers have assumed that the missionary's later days were engaged in the conversion of the early inhabitants of Bristol. Nevertheless, no mention of the town is to be found in any chronicles dealing with the centuries anterior to the reign of Alfred, and the first authentic proof that a community existed here is afforded by two silver coins of Ethelred the Unready (979-1016), attesting that they were coined by one Ælfwerd at "Bric.," which is undoubtedly a contraction of Bristol. Coins of Cnut also bear the local mint mark, and it seems unquestionable that by that time the town had grown to some wealth and importance, and was probably defended by its first walls.

The situation of this primitive collection of hovels deserves a brief description. Near the confluence of the rivers Avon and Froom was a small peninsula, nearly oval in form, surrounded on three sides by the natural defence of the tidal streams, and requiring protection from outward enemies only by a rampart thrown across the narrow neck of the eastern quarter. It is certain, however, that the inhabitants, some time before the Norman Conquest, had not only defended themselves by this indispensable bulwark, but had constructed a wall surrounding the whole area of the little town, covering a space of about nineteen acres. This had been found necessary owing to the peculiar character of the local tides, for the rivers were everywhere fordable at low water. The course of the wall was nearly circular, and it can still be followed by a pedestrian for nearly two-thirds of the circuit, though the perambulation would scarcely repay

the labour. The town itself, which is estimated to have contained about five hundred houses, was divided into quarters—the ancient wards—by the four main streets that still intersect it, Broad Street and High Street running from north to south, crossed by Corn Street and Wine (really Winch = pillory) Street from east to west. Intrenched as well by nature as by art in their little borough, which the annalist of Stephen's reign picturesquely describes as a "city seeming to swim in the waters," the inhabitants steadily increased in numbers and wealth as their infant commerce developed. There is reason to believe that each ward possessed a church in the time of Edward the Confessor, when it is known that the burghers were presided over by the King's reeve, or provost. Contemporary with this development, another little community had been growing up on the southern or Somerset side of the Avon, just as Southwark arose near London. The urgency of easy communication between the two towns must have been early felt, and as the name of Bristol was in its earliest form Bricgstow, it does not seem rash to conjecture, in despite of the fancies of amateur philologists, that the place derived its name from a wooden bridge, constructed at least as early as the tenth century. The southern town formed part of the royal manor of Bedminster, where there was already a church, but the portion adjoining Bristol, standing on an outcrop of New Red sandstone, early acquired the name of Redcliff, and rose to considerable importance before it was finally absorbed by its northern neighbour. It must be added that the peculiar physical features which first attracted settlers to the peninsula above referred to have now largely disappeared. In the first decade of the present century, the course of the Avon through Bristol, nearly three miles in length, was converted into a floating harbour or dock, the tidal stream being diverted into an artificial channel; whilst the Froom, deprived of the rushing tides to which it owed its primary importance, and reduced to a mere brook, was subsequently covered over throughout its urban course, and, to a stranger who may be standing in one of the new thoroughfares thus created, is practically non-existent.

The fall of the Anglo-Saxon dynasty provoked no local event worthy of record. So far, indeed, from following the example of some northern towns, the Bristolians were not only submissive to the Normans, but, in 1068, displayed at once the extent of their resources and their repugnance to rebellion by resisting and beating off the three sons of King Harold, who had entered the Avon with fifty-two ships, manned by Irish rovers, in the hope of plundering the town. It may have been the warning given by this incident which led to the erection of a castle on the weakest side of the defences, namely, on the narrow neck of the peninsula which communicated with Gloucestershire. There are strong grounds for believing that this fortress was raised by Geoffrey, the warrior Bishop of Coutances, who had immense estates in the neighbourhood, and was famous as a castle builder. About the same time the defences of the town were strengthened by a second wall, commencing at the castle, and enclosing a considerable extent of low-lying ground that had not been included within the first walls.

Such was the extent of Bristol at the date of the Great Survey recorded in Domesday Book. The town still remained a member of the King's manor of Barton, and rendered with the rest of the manor 110 marks yearly. But it is further recorded that "the burgesses," that is, the Bristolians proper, had informed the Royal Commissioners that thirty-three marks of silver and one of gold were paid to Bishop Geoffrey in addition to the King's rent, which sums were possibly assigned to him by the Conqueror in consideration of his building operations. The share of rent paid by the outlying Barton, then chiefly covered by forest, must have been inconsiderable, and Bristol seems to have been rated higher than any town save London, York, and Winchester. Geoffrey's castle could not have existed half a century when it was demolished by Robert, Earl of Gloucester, natural son of Henry I., who replaced it by a lofty keep, described by a monkish annalist as the flower of all the towers of England, and which was really inferior in size only to those of London and Colchester. After the death of Henry this fortress became the central bulwark of the revolt

against Stephen, who was for a time a prisoner within its walls. Soon after his departure, the Angevin boy who was to become Henry II. was brought here for safety, and was educated under the eyes of his uncle by a Bristol schoolmaster, later his Chancellor and Bishop of Angers ; the new King, in 1172, rewarding the town that had nurtured him by a charter giving Bristolians the city of Dublin as a place of habitation. Bristol and its castle having soon after become the property of his son John, by right of marriage, that prince granted the burghers the earliest charter of liberties now extant, and was a frequent visitor, chiefly for the purpose of hunting in the Forest of Kingswood, which enveloped the eastern and northern sides of the town. His torture, when king, of a Bristol Jew, by wrenching out the man's teeth one by one, until he ransomed himself for 10,000 marks, is recorded in our histories. The townsmen, however, were steadfast friends of John, and the town and castle, after his death, afforded the party of his son a secure base of operations. In 1224, Eleanor of Brittany, sister of Prince Arthur, was brought a captive to the Castle and detained there until her death, eighteen years later. The great local events of this period were the enlargement of the harbour by cutting a wide and deep channel for the Froom, the extension of the town walls, affording enlarged accommodation for the prosperous and increasing population, and the substitution for the old wooden erection of a solid bridge of masonry—a work of great difficulty at a place where the tides rose thirty feet. The original circular wall now became useless for the purpose of defence, and four of its gates were handed over to church builders, who raised new edifices or extended old ones over the ancient portals. Only one of those curious constructions—the base of the tower of St. John's—has been left for the inspection of antiquaries.

In 1284, after the conquest of Wales, Edward I. held a Parliament in this town, and kept his Christmas in the Castle. It is to about this date that an Early English porch leading to the royal apartments, which is almost the sole remaining relic of the once formidable fortress, may be assigned. During the troublous reign of Edward II. the

king twice sought refuge in Bristol, being removed on the second occasion by his enemies to Berkeley, where he was soon afterwards murdered. On the invasion of France by Edward III., Bristol contributed 24 ships and 608 men to the royal expedition, and London 25 ships and 662 men. Grateful for this generous aid, the King subsequently granted the townsmen a charter, conferring a privilege until then reserved to London alone, namely, the constitution of the borough into an independent county with separate shire jurisdiction. The absorption into it of the community on the southern bank of the Avon, and the creation of a Common Council were other important concessions. Richard II. paid two visits to the city with armies bound for Ireland. Under the Lancastrian kings the wealth and enterprise of the Bristol merchants enormously developed, their commerce extending from Iceland on the one hand, to the Levant on the other. Nor did they fail to give lasting proofs of their munificence. With the exception of a few modern spires, the churches thickly dotted over the old city were almost exclusively the production of the fifteenth century. Further privileges were granted to the burgesses by Henry VI. in 1446, during a visit paid to the west. Edward IV. was in the town a few years later, and glutted his vengeance on the Lancastrians by witnessing near the High Cross a judicial murder, immortalised by Chatterton's tragic ballad of "Sir Charles Bawdwin." Henry VII., in search of support and sympathy, lost no time in repairing to Bristol after Bosworth fight. Four years later, when firmly established, he came again, and, not satisfied with a "benevolence" of £500, levied a fine of 20s. each on all the townsmen worth £20, because their wives were too sumptuously apparelled. The great incidents of the reign of Henry VIII. were the suppression of the wealthy abbey of St. Augustine, and of two well-endowed priories, and of the erection, out of part of the estates of the former, of the bishopric of Bristol. The King once proposed to visit the city, but retreated in consequence of an outbreak of the Plague, which for many centuries periodically swept away the inhabitants by thousands. Elizabeth made a

"progress" to Bristol in 1574, and had a magnificent reception.

The queen of James I. paid a visit in 1613, and was so mightily entertained with a sham sea-fight and other festive manifestations that she thanked the city for its love, declaring "she never knew she was a queen till she came to Bristol." The merchants had reason to remember her, for the Court, during its stay in the neighbourhood, demanded wines from them to the value of £800, by way of purveyance. In the Civil War, which followed in the next reign, the possession of Bristol was naturally coveted strongly by both parties. At the outbreak of hostilities the civic authorities admitted a Parliamentary force, and measures were forthwith taken to raise a fresh line of defences, far in advance of the old walls, over which the population had largely overflowed. The new works were about five miles in length, and considerable remains of one great bastion may still be seen near the summit of Brandon Hill.

Whilst the fortifications were proceeding, however, Prince Rupert advanced with 20,000 men, in the summer of 1643, to besiege the city, and a dashing attack at the unfinished trench and wall, at a spot nearly opposite to the present Blind Asylum, led to an immediate surrender of the town. But in 1645 the discomfiture of the royal cause in the west was consummated by the successful storming of Bristol by the army under Fairfax and Cromwell.

The Castle had by that time become ruinous, and during the Protectorate the massive keep was razed to the ground, to the lasting lamentation of antiquaries. The visits of Charles II. after his restoration, of James II., who was on his way to inspect the scene of Monmouth's rout at Sedgemoor, of William III., after his victory at the Boyne, and of Queen Anne in 1702, present no features of interest.

The prosperity of Bristol greatly declined during the reigns of the Tudors, and showed no evidence of a rebound until the conquest of Jamaica, the acquisition of other West India islands, and the growth of the American colonies. Commerce was then directed into new channels, and advanced with surprising strides in spite of the gradual

decay of the cloth trade, for which the city had long been famous. The direct intercourse with the New World was lucrative, but its profits were not comparable with those arising from the export of English goods to Africa for the purchase of slaves, the sale of the captives to the West India planters, and the freight homewards of rich cargoes of sugar and other tropical products. Such a triangular voyage occupied a twelvemonth.

To give some idea of the profits of a successful cruise it may be stated on the authority of existing documents that about 1727-8, a cargo of 270 slaves could be obtained at a cost of £2 15s. per head, paid in the shape of iron and copper rods, cotton fabrics, spirits, &c., and could be sold in Jamaica for nearly £31 per head, making a gross profit of £7,600, or vastly more than the value of the small vessel engaged in the transit. As the demand for negroes increased prices rose in Africa, but there was an equivalent rise in the West Indies, and the profit was still £28 per head when Clarkson began his crusade. Before that date, however, the commerce of Bristol had sustained a terrible shock by the revolt of the American colonies, which wrought havoc amongst the leading mercantile firms, and reduced for a time the trade of the port by 50 per cent. Notwithstanding its reverses, the city showed itself intensely loyal on the breaking out of the great French War. A subscription was started in 1794 for the raising of a regiment of infantry for the service of the Crown, and the "Loyal Bristol Regiment" —afterwards the 103rd of the Line—was equipped at a cost of nearly £5,000. Four years later, in a time of great embarrassment and danger, a "Patriotic Fund" was proposed for the purpose of supporting the Ministry, and on the 15th April the local newspapers stated that the subscriptions then amounted to £31,300. At the same date the Liverpool subscription stood at £17,000, that at Manchester £20,000, and that at Birmingham £10,000.

The motto of Bristol in the last century, whatever may be that displayed on its heraldic shield, was *Quieta non movere*. The citizens having found prosperity in following the commercial routine adopted by their forefathers, generally

resisted plans for improvement on the favourite old principle of "letting well alone." There is extant evidence to prove that weddings often took place at four or five o'clock in the morning in the days of Queen Anne; boys went to school at six o'clock, when the coffee houses began to fill with traders; the court of quarter sessions opened at seven o'clock, and the mayor took his seat in the council chamber at nine o'clock, when fines were imposed on laggard councillors. The back of the day's business was thus broken before dinner at noon, and in the evening, when there was little to read, and no light but tallow candles, the most belated burghers, generally inebriated, sought their beds when the great bell of St. Nicholas rang the curfew knell at nine o'clock.

In spite of the mercantile activity of the port, the city was a Sleepy Hollow, and its fits of progress were few and far between. On one of these occasions the wealthy merchants, feeling cramped in the old mansions looking on the busy streets, resolved on establishing themselves apart in a stately square, stated to have been, when erected, the largest square in Europe. Two sides of this quadrangle remain nearly intact, and show what genuine "Queen Anne's houses" really were. The other two sides, saving only a couple of houses, and including the Mansion House, the Custom House, and the Excise Offices, were destroyed by fire during the great riots in 1831. In the centre is a noble equestrian statue in bronze of William III., one of the finest productions of Rysbrach. This was erected in 1736, and was prompted by the indignation of the local Whig merchants at the refusal of a site for a similar monument by the Tory corporation of London. After the building of Queen Square, the citizens rested thankfully for many years amidst their old surroundings. At length it occurred to them that the system of transacting most of their mercantile business, in all sorts of weather, in the crowded narrow streets might be improved upon to the convenience of all parties. The building of an Exchange was therefore proposed in 1717, and went forward in a characteristic fashion, the task being happily accomplished at a cost of £50,000 in twenty-six years.

Proud of their achievement, the inhabitants took another long breath until about 1760, when the ever-increasing population, still confined to the ancient boundaries, began to pant from want of elbow room, and to look with envy on the green dairy farms on the hills overlooking them. Clifton with its romantic rocks lay beyond their desires. There was abundance of space there, indeed, more than nineteen-twentieths of the parochial area on the high ground being occupied by farmers or lying as open common; but the scanty patches covered with mansions and gardens were reserved for local notables and fashionable visitors to the Hot Well, on whose privacy the burgesses had no wish to intrude, even if the endless highway robberies in the narrow lane communicating with the village had not been a still more powerful deterrent. The summit and slope of the closely adjacent Kingsdown were, therefore, chosen by well-to-do traders as more convenient for suburban retreats, and houses gradually covered them, to the intense disgust of conservative-minded citizens. It was noted, however, that many of those who clung to their old dwellings took compassion on their children, educated in the stifling city, and sent them to Kingsdown during the summer vacation for change of air. The spirit of progress, moreover, was abroad, and the authorities felt it absolutely necessary to improve the constricted leading thoroughfares. Bristol Bridge, lined by houses on each side, like its prototype in London, was barely wide enough to permit one coach to pass another, pedestrians in such cases being forced to take refuge in the shops, and serious accidents were of weekly occurrence. After a long and bitter controversy, the ancient structure was superseded by one more commodious, still in existence but doubled in width; and this advance necessarily led to another—the throwing open of High Street by removing St. Nicholas's Gate, which throttled the southern entrance into the city. This, again, led to the destruction of St. Nicholas' Church, the chancel of which stood over the portal. Soon after a vast crowd of dwellings was swept away to open a communication between the bridge and the northern parts of Bristol. Next came the removal of St. Leonard's Church,

standing over the gateway at the west end of Corn Street, necessitating a still greater demolition of dwellings closely packed together between that spot and the quays. Bye and bye the wealthy class began to take flight from the town in earnest, and the mason was more than ever in request. Two new squares were laid out amongst the green fields in the north-eastern district, while the dairy farms which ran down to within a stone's throw of College Green were purchased for building sites by professional men and merchants. The zeal for extension at length developed into an unreasoning mania. Gigantic schemes for streets, rows, squares, terraces, and crescents were propounded and eagerly taken up in the last decade of the century, Clifton being at length invaded in force, and two or three enormous piles of first-class dwellings there were actually commenced. Then came the tremendous financial panic that swept over the kingdom on the outbreak of the revolutionary war in 1793, when speculating Bristolians sank hopelessly in the storm. The aspect of the suburbs for many succeeding years reminded strangers of a place that had undergone bombardment. Malcolm, the historian of London, who visited Clifton so late as 1807, described the tottering ruins to be seen in every direction as the most melancholy spectacle he had ever witnessed. It was not until far into the present century that two of the most stately piles of building designed before the crash—Royal York Crescent and Cornwallis Crescent—were completed in their present form.

It seems natural to suppose that in a city the prosperity of which mainly depended on its commerce with foreign countries, ideas of improvement, when they first began to take root, would have been chiefly directed to removing those difficulties of navigation which had always rendered the port troublesome and perilous to mariners. The peculiarity of the local tides has been already casually mentioned. It may be accurately appreciated by any stranger who views the Avon from the neighbourhood of the Suspension Bridge. At high water the turbid stream fills its basin to the brim, and vessels of 3000 or 4000 tons burden sail majestically

up and down. At low water, the river is simply a muddy ditch, which in some places is barely knee deep. And nowhere was this contrast more startling than at the city quays in the last century.

Pope gave a graphic description of Bristol and its shipping during his visit in 1739. "You come," he wrote, "over a bridge, built on both sides like London Bridge, and as much crowded, with a strange mixture of seamen, women, children, loaded horses, asses and sledges with goods, dragging along altogether without posts to separate them. From thence you come to a key, with houses on both sides, and in the middle of the street, as far as you can see, hundreds of ships, their masts as thick as they can stand by one another, which is the oddest and most surprising sight imaginable. This street is fuller of them than the Thames from London Bridge to Deptford." When the tide was out, the ships were all aground, and then "a long street full of ships in the middle, with houses on each side, looks like a dream." It is obvious that heavily-laden barks, stranded twice a day, were liable to be severely strained ; in point of fact there is evidence that many "broke their backs" from time to time ; and distant shipowners, knowing the perils, were cautious in accepting freights to so singular a harbour. Bristol ships, however, were built with abnormal solidity, to guard against the dangers of grounding, and Bristol shipowners and merhants, thoroughly adopting the ideas prevalent in their generation, were by no means displeased at virtually monopolising the commerce of the city and driving their rivals elsewhere. Their stolid inertia unquestionably promoted and accelerated the progress of Liverpool, which in the reign of Anne had hardly any shipping whatever.

At length, with the constant growth of the West India and American trades, some leading Bristolians began to admit that the shipping accommodation of their port was no longer adequate to its requirements, and the Corporation was besought, in 1755, to take the matter into consideration, it being urged that ships sustained damage daily owing to the manner in which they were crowded together. The Corporation, in which the merchants were all-powerful,

refused to take any action, but eventually advertised for plans for a dock; then abandoned that design, and finally fell back upon a make-shift—a short extension of the existing quays—at a cost enormously disproportionate to the trivial benefit secured. The quays of Bristol, it may be observed parenthetically, are amongst the most extensive and most commodious in the kingdom. The corporate expedient did not prevent revived efforts for harbour extension. Plan after plan was produced, only to be discountenanced and shelved, self-interest and sluggishness obstinately blocking the way. Although the natural result was immensely to the advantage of Liverpool, whose commerce increased by leaps and bounds, the eighteenth century came to an end without any effort having been made in Bristol to maintain its former supremacy. And when, in 1803, some public-spirited citizens determined to break down the obstacles to amelioration, the Bill for carrying out a floating-harbour scheme encountered a fierce and stubborn resistance in Parliament. The assent of the Corporation was gained by a majority of only one vote, the dissentients including nearly all the leading merchants, who vehemently denounced the tax that would necessarily be imposed on their shipping to recoup the cost of the works. The Act, however, was obtained, the Bristol Docks Company came into existence with a capital of £300,000, and the undertaking, the boldness of which exceeded that of any engineering work previously attempted in the kingdom, was soon afterwards commenced. The excavation of a new bed for the tidal river over two miles in length, was the preliminary task, and was itself regarded as a Titanic enterprise. A lock was then constructed at each end of the old course proposed to be enclosed, thus securing a floating harbour two miles and a half long and over eighty acres in area. Two basins communicating with the tidal river completed the design. As is not unusual in hydraulic engineering, the total expenditure incurred just doubled the amount of the estimate, and brought about evils hardly less damaging than those that had been removed. The Company, to secure interest on their investments, imposed

dock dues greatly in excess of the charges at other ports, and the shipping trade was crippled by a burden that indirectly affected all local business. It was shown in 1846 that the charge on the principal articles of commerce imported was 8s. 8d. at Bristol against 4s. 6d.at Liverpool and 1s. 7½d. at Hull; whilst the shipping due was 2s. 7d. per ton at Bristol against 9½d. in London and 3d. at Southampton. The situation at length became intolerable, and the Corporation was compelled by public opinion to take over the entire dock estate for £516,000, security being given to the Company for the yearly rent-charges covenanted to be paid on the transfer by the imposition of a rate on the fixed property within the city boundaries. By subsequent financial operations the shareholders were paid off, and the Company was dissolved. Immediate reductions in the dock dues were made with satisfactory results, and further remissions have since become practicable. The chief promoter of this emancipation of local commerce was Mr. Robert Bright, whose family is known throughout the empire in connection with the firm of Gibbs, Bright & Company.

This brief record of local events would be seriously incomplete if no mention was made of the wealthy and influential corporation styled the Society of Merchant Venturers. The Merchants' Guild of Bristol was a powerful confederacy so early as the days of Edward the Second, when it appears to have obtained a predominance in municipal affairs, and to have practically deprived the burgesses of their previous privilege of electing the mayor and bailiffs. The usurpation led to a remarkable incident that has been overlooked by English historians. The burghers rebelled, first against the dictators, and next against the weak king who supported them, built a "wall of defence" between themselves and the Castle, elected corporate officials satisfactory to themselves, collected and expended the Customs of the port, and set the Royal authority at defiance for upwards of two years. There was, in short, a civil war on a small scale. At last the town was reduced by a regular siege, and a heavy fine was extorted from the rebellious inhabitants before they were granted a pardon and the

restoration of their former chartered rights. The "Great Insurrection" was not, however, a failure, for municipal affairs were henceforth conducted with more regard for public opinion. For the next two centuries the Merchants' Company seems to have been a sort of Committee for Trade of the Corporation, controlled by it in appearance, though probably not in fact, for the controllers were, many of them, merchants themselves. In 1552 a nominal separation took place between the two bodies, a charter being obtained from Edward the Sixth instituting an independent incorporation under the title of the Master, Wardens, and Commonalty of Merchant Venturers, and an Act of Parliament was passed in the 8th Elizabeth confirming the privileges conceded to this body, in whom was vested a monopoly of the mercantile trade of the city. To this, however, the municipal corporation, now become more representative of public feeling, strongly objected, and the Act was repealed in the next Parliament. The Merchant Venturers were granted fresh charters by Charles the First and Charles the Second, and, though they never succeeded in suppressing the competition of those outside their confederacy, they long gathered in nearly all the leading merchants of the port and gradually increased in influence and wealth. Their first Hall was established, soon after their incorporation, in a chapel dedicated to St. Clement, but desecrated at the suppression of the chantries. The present Hall, unpretentious outwardly, but stately within, was built in 1701, and refronted ninety years later. It has long been celebrated for the costly entertainments offered by the Company to distinguished visitors. Adjoining it is a large almshouse for aged mariners, erected and maintained by the Company.

Within recent years the Society has made a munificent contribution to the educational institutions of the city by founding a College of Technical Science and Art, equipped with laboratories and engineering and other workshops, drawing schools, etc., with a large staff of competent teachers. Attached is a second-grade school of an equally efficient character. The institution, which has cost the Society little short of £60,000, was established upon a

pre-existing Trades' School, the first of its class in England, opened in 1856.

The Merchants' Society are Lords of the Manor of Clifton and owners of the appurtenant estates. Purchased in the seventeenth century, when the lands were almost purely agricultural, the Society has reaped a rich harvest from the investment since the ground has been covered by villas. With great liberality, however, it gratuitously surrendered its manorial rights over Clifton Down in 1860, when that common and the adjacent Durdham Down, forming one of the most delightful features of the western suburb, were secured by the Corporation for the perpetual recreation and enjoyment of the citizens.

THE ARCHITECTURAL FEATURES OF BRISTOL.

By Lt.-Colonel JAMES R. BRAMBLE, F.S.A., Hon. A.R.I.B.A., President Clifton Antiquarian Club.

THERE are no remains in Bristol of very early architecture, either Ecclesiastical or Civil. Of Norman there are some remains in the Cathedral itself, and in the small portions of domestic buildings to the south of it. The chapter house, etc., are Transitional. The nave of St. James' is Norman, so is a great part of All Saints' (Corn Street). Of Early English work there is the Lady chapel on the north side of the Cathedral, and portions of St. Mary Redcliffe and of St. Philip's. Of Decorated work there is the greater part of the Cathedral east of the nave, and the Mayor's Chapel. But most of the churches are of the fifteenth century or later.

Bristol in the west, like Norwich in the east, has been designated the "city of churches." Some of such churches, as St. Giles at the bottom of Small Street, and St. Lawrence at the west of St. John's in Broad Street, have long since disappeared. St. Leonard's at the west end of Corn Street, and St. Ewen's at the east end of the same street occupying the site of the Council House, were pulled down early in the century; St. Werburgh's, in the same street, some twenty years ago. St. Bartholomew's, in Union Street, had the somewhat unusual experience of being erected and pulled down within a quarter of a century. But the view of towers and spires as seen from the hills above is still a very striking one.

To particularize some of the principal Ecclesiastical edifices :—

THE CATHEDRAL was the church of an abbey of Canons Regular of St. Augustine, founded 1142, suppressed and constituted as a cathedral by Henry VIII. It consists of choir and nave (both with aisles), transepts, Lady chapel east of north transept, central and two western towers and a north porch. The nave, its aisles and western towers

have been erected at intervals since 1865 in the Decorated style under designs of Mr. Street, and subsequently of Mr. Pearson. The earlier portions have little of the original Norman work remaining. Substantially they are Flowing Decorated of c. 1330-40 with tower and other perpendicular additions of Abbot Newland, 1480 to 1500. The Lady chapel, however, is good Early English work of c. 1200.

There is no clearstory, the choir and nave with their aisles being all of equal height. This peculiarity seriously diminishes the apparent size of the building from the exterior, without any equivalent advantages.

Observe (1) The manner in which the thrust of the groining is carried across the aisles by "a stone beam" supported by an arch; a practical modification of the usual "flying buttress." (2) The unusual amount of tracery below the transoms of the fourteenth century windows. (3) The sepulchral niches in the side walls. (4) The lines of inscribed stones in the north choir aisle which clearly define the external line of the original narrow Norman aisle.

South of the Cathedral stood the chapter house and domestic buildings. The former is of late or transition Norman, the vestibule being remarkably fine. The Refectory has been converted into a schoolroom. South and east of these are portions of the lower or Infirmary Cloister and of the Abbot's House. The latter, converted into a residence for the Bishop, was destroyed by fire in "The Bristol Riots" of 1831.

West of the Cathedral is a fine late Norman arch leading to the Lower Green or College Square. The whole of the upper portion is a recent restoration.

The Cross in the centre of the Green is a modern copy of the Bristol High Cross, which formerly stood in the intersection of the four main roads in the centre of the city (Corn Street, etc.). The original is at Stourhead.

St. Mary Redcliffe. — Probably the finest parish church, erected as such, in England. (*Note.* Sometimes erroneously said to be the largest, but St. Nicholas', Great Yarmouth, is of at least equal length, 230 feet; and, in each

case excluding transepts, double the breadth—108 feet as against 54. Boston, Coventry, Hull and Nottingham have also larger churches.) The Church comprises choir, with Lady chapel east; north and south transepts, each transept having a western as well as an eastern aisle, an unusual feature; nave, with aisles; western tower, with spire; a very rich and lofty octagonal porch on the north side (the upper loft contains the muniment chests in which Chatterton alleged he discovered the "Rowley MSS."), and a two-storied south porch. There are several small chambers attached to the church—probably the cells of Anchorites, caretakers or others having duties in connection with the fabric. Remains of the original Norman church—carved stones, etc.—are preserved. The lower portions of the tower are of Early English date, but the greater part of the spire is of recent erection.

Under the tower is the monument of Sir Wm. Penn, father of the founder of Pennsylvania. He died 1670. Near it is the "rib of the dun cow," traditionally said to have been killed by Guy of Warwick. It is actually the rib of a whale—no doubt "Ye bone of ye big fyshe" presented to the Corporation by Cabot, after his discovery of Newfoundland, and for setting up which they paid vid., and for "two rynges of iron iijd.," in 1497.

Observe (south transept) the tomb of Wm. Canynge the younger, who restored (to a great extent rebuilt) the church, also a list of his ships. He is again represented on another tomb, brought from Westbury-upon-Trym, in his vestments as Dean of the Augustinian College there.

An effigy in stone of one of the Berkeley family in chain armour (c. 1270), is in north transept. Brasses to Chief Justice Sir John Inyn, 1439, Judge Brook and wife, 1522, and John Jay, 1480, are in the rear of the high altar.

The lady chapel (east of altar), restored by the Freemasons of the province, and the wrought iron gates at the entrance of the middle aisle should also be noticed.

"Temple" or "Holy Cross" occupies the site of a church of the Knights Templar, whose house stood south

of it. The original church was oval in form. The foundations were discovered, at a recent restoration, about the centre of the present building, which dates from the end of the fourteenth century. The tower is of two dates, the upper stage having been added 1460. The whole leans considerably (some four feet) to the west, owing to the failure of the foundations, the ground being a marsh. For the same reason the nave walls have "spread."

Observe the Brass Candelabrum, small but of exquisite workmanship, in the chancel—St. George and the Dragon, Virgin and Child, etc.

The Chapel, north of the chancel, was the property of the Weavers' Guild or Company; it is dedicated to St. Catherine.

ST. MARY-LE-PORT, or DE FORO, formerly on the river bank, but now between Bridge and St. Mary-le-Port streets—the former having been erected some 130 years ago on the site of the old Shambles—is a Perpendicular building, comprising a nave, north aisle, and chancel (not central with the nave), and west tower. Sixteenth century houses are erected against the north wall and overhang the aisle roof. Here is the fine eagle desk or lectern of brass formerly in the Cathedral. It was sold in 1804 by the then Dean for about £27 as old brass, but was subsequently purchased by Mr. Wm. Adey and placed in this church "there to remain for ever."

ST. JAMES' comprises the nave of the church of the former Benedictine Priory, a cell to the Abbey of Tewkesbury. It has a good Norman west front, with an arcade comprising both round and pointed arches, with chevron mouldings. The nave arcades are semicircular, and are supported upon massive round piers, with a clearstory of very irregular construction but of similar date. The choir or chancel was pulled down at the suppression of the house, but the nave, having been made parochial from the beginning of the fourteenth century, was preserved. The south aisle was rebuilt about 1700, at which time the Perpendicular tower was spoilt—in the taste of the period. The north aisle,

good in itself, but hopelessly incongruous, dates only from 1864. The Monastic buildings were extensive, but appear to have been very irregular in design and varied considerably from the usual plan. There is in the south wall a good effigy of a civilian, of about 1240, supposed to be that of Sir Richard Grenville, the founder, whose arms have been attached to it in modern times.

St. Philip and St. James (or St. Jacob as usually termed) was also originally the church of a Benedictine priory. Although externally it has the appearance of very debased Perpendicular work, on internal examination it will be found that all the eastern part is good Early English, the pillars having been recased. There is a good but mutilated effigy traditionally supposed to represent Robert of Normandy, eldest son of William the Conqueror, but actually of the date of about 1380.

St. Mark's, or the Mayor's Chapel, in College Green, was the church, and possibly also comprises the Hall, of the Hospital of the Gaunts, founded for the maintenance of a number of poor brethren. Internally it is of considerable beauty architecturally, and it contains numerous sepulchral effigies of the Gaunt, Fitzharding, and other families. A small chapel south of the chancel is exceedingly good. This church was until a few years since fitted up in the style of a choir or college chapel. It is now in its arrangements a bad imitation of a parish church, for which, from its dimensions, character, and use, it is quite unfitted. Some traces of its original semi-monastic arrangements can be readily perceived. The Bristol Grammar School formerly adjoined it on the east, but the buildings of the Merchants' Technical College now stand on this site.

The Church of St. Stephen is noticeable for its tall and graceful tower, with its pierced parapets and turrets. It is throughout of good fifteenth century or Perpendicular date, and contains the monumental effigy of one of the Blanket family, the inventor of that article of world-wide use.

ST. NICHOLAS' AND ST. JOHN'S churches have good crypts—that of the latter, with its altar tombs, being of particular interest. This church also contains a remarkably fine hour-glass stand of wrought iron.

THE MONASTIC REMAINS still existing are few. For the remains of the Austin Canons' House—the Abbey of St. Augustine—see the "Cathedral." The *Dominican* Friary is in Quakers' Friars, the Society of Friends having long carried on a school there. It is of late Early English date, and of considerable merit. Extensive portions of the Cloister and the Refectory remain. It is now a Board School. Of the *Franciscan* Friary small portions remain north of Lewin's Mead, in the "Grey Friars." The house of the *Carmelites* occupied the site of the present Colston Hall, which itself succeeded Colston's House and School, on the latter being removed to the old "Bishop's Palace" at Stapleton.

THE CASTLE OF BRISTOL, founded in the eleventh century, stood east of the city, extending from near the end of Wine Street to the Old Market. The Moat is still clearly traceable; and turning from Castle Street into Castle Green two vaulted and groined chambers, one of the thirteenth and one of the fifteenth century, will be seen on the right or east side. In the one a room has been constructed beneath the vaulting, the other is used as a stable. Strong but ineffectual efforts were made some time since to secure and preserve these as part of the adjoining Board School premises. In the sub-structures of many buildings in this locality other portions of the Castle still exist, but they possess no important architectural interest.

THE ALMSHOUSES, of late sixteenth, seventeenth and eighteenth century date, are numerous and quaint. The usual plan is that of a courtyard—square or oblong, as the site rendered necessary—surrounded by the chapel and the (usually two-storied) houses of the inmates. The following are worthy of notice: *Burton's Hospital*, Long Row, Temple, and *White's Hospital* in the same street; *Foster's Almshouse*, at the top of Christmas Steps, with its chapel

dedicated to the "Three Kings of Cologne"—the traditional Magi: it was founded in 1483, but a great portion of the existing building dates from 1873 only; *Colston's Almshouse*, on St. Michael's Hill; *Merchant Tailors'* almshouse, in Merchant Street; the *Merchant Seaman's* almshouse, in King Street; *St. Nicholas'* almshouse, a quaint gabled building at the corner of King Street and Queen Charlotte Street; *St. John's* and *All Saints'* almshouses near Broad Street; *Blanchard's* and *Ridley's* almshouses in Milk Street; and *Trinity* and *Stevens'* almshouses in the Old Market.

Of modern almshouses, the *St. Raphael's*, for aged seamen, adjoining the church of that name, in the Cumberland Road; *Lady Haberfield's*, at the Hotwells; and *Hill's*, in Berkeley Place, are to be noted.

Like London, Bristol had formerly many Trade Guilds or Companies owning halls. In Tailors' Court, Broad Street, is the Hall of the Company of that name, now used for the purpose of a lithographer's business; and in King Street is the more pretentious classic hall of the Coopers' Company. The Weavers' Hall, in Temple Street, and others, have disappeared.

Of the CIVIC BUILDINGS it is well to say little. The *Council House*, at the corner of Corn and Broad Streets, has received the addition of the old Police Courts, but is still notoriously insufficient for its purpose, and for a long series of years the Council has failed to agree as to the proper remedy. The Guildhall, extending from Broad Street to Small Street, in which the Assize, Quarter Session and County Courts are held, is probably equally convenient, or inconvenient, for all those purposes. The new Police Courts in Bridewell Street, adjoining the Central Police Station, are remarkable for multiplicity of doors and draughts. But the evidence can be heard—sometimes. The Municipal offices are impartially distributed over a large part of the central area of the city. The Dock offices in Queen Square, however, and the Granary, near the Bathurst Bridge, are in good taste and well adapted for their respective uses.

With the exception of the graceful Suspension Bridge—a feat of skilful engineering rather than an architectural work—there are no bridges worthy of mention. "Bristol Bridge," at the foot of High Street, was re-erected in 1760, in stone, and in 1860 side pavements, supported by iron girders, were added. They are useful, but the arrangement is not, from an architectural point of view, a success.

As in most cities originally surrounded by walls, the streets in the central part of Bristol are narrow and contracted. Much less so now than formerly; the last half century has seen the clearing away of a great deal of the picturesque, and not a little that was unwholesome.

Until within the last year, one old street, "The Pithay," opening out of Wine Street, composed almost entirely of sixteenth and seventeenth century houses, remained practically untouched. There is not now a single instance remaining of the narrow streets with houses whose upper portions projected one beyond another until at the fourth or fifth storey they were kept apart by short struts, and it would have been practicable to shake hands from opposite windows. Such it was in St. Nicholas and St. Mary-le-Port Streets, as well as in other minor streets of the city. An ordinary cart blocked the entire roadway, and also, not infrequently, one or more of the narrow pavements.

In St. Mary-le-Port Street, however, may still be seen a range of picturesque half-timbered houses. Those on the south side, about the middle of the street, are built not only against the north wall of the church, the aisle windows being blocked for the purpose, but are actually bracketed out so as to overhang the aisle roof. The shields on the fronts of two of them are those of the Brewers' Company. A range of rather later houses may be seen in King Street—which, being outside the walls, was of much greater width—and throughout the older portions of the city and its eastern and southern suburbs, specimens of the old town houses of varying dates and sizes may be seen. Two in the Old Market are built on pillars, so that the upper stories completely overhang the wide pavement. Under the eastward of these houses the ancient "Pie Powder" Court (held at

fair-times with a view to affording speedy justice), used, until within the last few years, to be formally opened.

The venerable-looking, battlemented timbered house, standing at the corner of High and Wine streets, is not in the same category. It is said to have been imported from Amsterdam, and bears the date 1676.

Many of the older houses have vaulted and groined store cellars extending under adjoining streets. These have been mistaken in some cases for the crypts of Ecclesiastical buildings.

The finest mediæval house is that known as St. Peter's Hospital. The present building is to some extent of the fourteenth and fifteenth centuries, but very extensive alterations were carried out in the beginning of the seventeenth century. It was originally the residence of the Norton family (Thomas Norton the Alchemist resided here 1478), then of the Newtons of Barrs Court. Subsequently it became a sugar refinery; from 1695 to 1697 a mint. In 1698 the Corporation purchased it for a workhouse, and the meetings of the "Corporation of the Poor" were held here until its abolition a few months since; and since of its successors. The Board-Room, with its oak panelling and plaster ceiling, and the quaintly-carved brackets in the front, should be noticed. The roof is good, but inaccessible.

There are considerable portions of a fine Norman house with later additions incorporated, in the Small Street portion of the Guildhall, and now used as a law library. It is generally, but erroneously, called "Colston's House." Other fine specimens of mediæval domestic architecture are the Water Company's Board-Room, Small Street; Canynge's House, Redcliffe Street (the residence of the restorer of St. Mary Redcliffe), and the house of Messrs. Franklyn, Morgan & Davey, on the Welsh Back. Numerous others are concealed behind modern fronts of the most unpromising character.

Of other more modern buildings there are good examples of what to do, as well as what to avoid. Of the former may be mentioned: The Victoria Rooms, with a fine Corinthian portico, although the internal arrangements leave much to

be desired, partly, no doubt, attributable to the more exacting requirements of modern times. The Commercial Rooms, a well-proportioned Doric building, but completely dwarfed by those surrounding it. The Corn Exchange—formerly a cloister with covered alleys, but now roofed, and thus adapted to modern civilization. (This building took the place of the old "Tolzey," adjacent to All Saints' Church. The bronze tables in front are interesting. There is a similar table at Axbridge. From them, the phrase "Paying down on the nail" is said to have been derived). The principal Banks: Lloyds Bank, however (formerly the "West of England"), while a fine building, is yet wholly inappropriate for the purpose for which it was designed.

The City Library and Museum, Queen's Road, in the style of the Doge's Palace at Venice, is another instructive illustration of how a building, admirable in its original position and for its original purpose, may, under other circumstances, be utterly out of place and incongruous.

Some of the modern buildings in Clare Street, designed in the Jacobean style—a very effective one in street architecture, and producing a picturesque and harmonious effect—should be noticed.

The buildings of the *Merchants' Technical College*, in the rear of College Green, are well designed and adapted for their purpose, but suffer severely from the want of a frontage to the Green, the ground on that side being occupied by shops.

The Merchants' Hall, in King Street, contains some fine rooms, but its exterior is not remarkable. Nearly adjoining it is the central City Library, a good house of its date, with some fine oak carving, but hopelessly insufficient for its present purpose.

The most modern public building is the *Cabot Tower*, occupying a very prominent position on Brandon Hill. It is Venetian-Gothic in design, suggesting the nationality of the family whose deeds are commemorated.

Bristol contains some fine buildings devoted to educational purposes, all of modern date, although many possess endowments of some antiquity.

Clifton College, from the designs of the late Mr. Charles Hansom, is in the late Perpendicular style, and of very considerable merit both from an architectural and practical point of view. The Grammar School, in Tyndall's Park, and Queen Elizabeth's Hospital, on Brandon Hill, are also noticeable. The numerous Board Schools will be readily recognised.

Near the top of Park Street, the Blind Asylum, in the thirteenth century style, and an adjoining building in Tudor style, erected for the "Red-maid" or "Whitson" School, and successively the Bishop's College and a Club, form, with the City Library and Museum previously referred to, an extensive but incongruous mass of building. Other public buildings—quæ nunc prescribere longum est—will be found throughout the city and suburbs.

DOCKS, RIVER AND TIDES.

By JOHN M. McCURRICH, M.A., M. Inst. C.E.,
Docks Engineer to the Corporation of Bristol.

UP to the early part of this century Bristol was the second port in the United Kingdom. The position of the port was favourable both for foreign and coastwise trade; but with the development of great manufacturing industries in Lancashire, Yorkshire, and other parts of the country, and with the facilities that could be given for vessels of large size, Liverpool and several other ports were placed in a better position, and while there has been a steady increase in trade, Bristol does not now occupy anything like the relative position it once did. The port of Bristol includes the Old City Docks and those at Avonmouth and Portishead, near the mouth of the river Avon, the latter being connected by railway with Bristol.

Bristol became known as a port at a very early period. Being the centre of a large district and situated on a navigable river, a short distance from the sea, its position was favourable for trade and commerce. While vessels could easily come up the Avon, the approach was of such a nature as to render it capable of being readily defended, and hence Bristol was safe from piratical attacks from sea unless made in overwhelming force. The rise and fall of the tide enabled vessels to go up or down the Avon simply drifting with the tide. An old writer about the middle of the 12th century describes Bristol as: "A certain part of the province of Gloucester, being narrowed in to the form of a tongue and extended a long way, forms the City, two rivers washing two of its sides, and meeting together in a great abundance of waters on the lower side where the land itself is defective (meaning the Marsh ground which admitted high tides to the city wall that extended from the Avon to the Frome on the north side of King Street, etc.). Moreover a quick and strong tide, ebbing and flowing abundantly night and day,

causes the rivers on both sides of the city to run back upon themselves into a wide and deep sea, and forming a port very fit and safe for a thousand vessels, it binds the circuit of the city so nearly and so closely that the whole city seems to swim on the water and sit on its banks."

The first notice we have of any engineering work being carried out for the improvement of the port of Bristol was in 1239, when the ground for the trench in the Marsh of St. Augustine's was purchased by the city from the Abbot of St. Augustine's Monastery. That trench, which was made wide enough to accommodate shipping, was an enlargement of the course of the Frome from its junction with the Avon, opposite what is known as Prince's Wharf to Stone Bridge about half-a-mile higher up, and was completed in 1247 at a cost to the city of about £5,000—a large sum of money in those days. It was one of the first works of the kind carried out in England, and was looked upon as a very great undertaking.

The trade of the port was carried on in small vessels, a considerable proportion of the trade being with coast towns and with Ireland. From September 1613, to June 1614, 104 vessels imported 25,105 quarters of grain, or an average of 240 quarters per vessel ; at the present time, vessels come up to Bristol carrying from 15,000 to 18,000 quarters of grain, and one vessel has brought over 21,000 quarters. We should now think the vessels that used the river about two centuries ago very small, but they were then thought dangerous to navigation from their size. In 1662, we find that owing to "many inconveniences having happened to the river and haven by the coming up of ships out of King Road," the Corporation ordered that no vessel of above sixty tons should come from King Road to the city under a penalty of £10.

In 1712, a dock was begun at Sea Mills, about four miles below the city. It was probably thought that a dock in that position would be greatly used, as vessels would be enabled to avoid the most difficult portion of the river. The dock did not, however, prove a success. It was the third wet dock constructed in England, the others being the

Howland Wet dock at Rotherhithe on the Thames, constructed under an Act of 1696; and the Old dock at Liverpool constructed somewhat later.

As the city extended, it was found to be inconvenient to go to the Stone Bridge to get across the Frome, and a drawbridge was therefore constructed about 250 yards lower down. That bridge was replaced in 1827 by a swing bridge, and again by another swing bridge in 1868, and it was proposed in 1889 that it should be replaced by a bridge of much greater width, constructed on the bascule principle. This proposal was, however, opposed and, after a great deal of discussion, the Drawbridge was removed and in 1893 the Frome was covered over from the Stone Bridge to the site of the old Drawbridge.

From time to time, during the 18th century, new wharves were added, the most important undertakings being "the Mud dock" at the Grove, and the Quay Wall at the Welsh Back. A new wet dock, called the Merchants' Dock, was begun on the north side of the river Avon near the Hotwells. It was finished in 1768, and was found to be very convenient for shipping, as vessels could be kept afloat in the dock at all times, there being a lock between the river and the dock. At the various quays in the city vessels lay on the mud at times of low water, being specially built for the purpose of bearing the strain. It was admitted that the provision for accommodating vessels was unsatisfactory and various schemes were proposed. In 1792, Mr. Jessop proposed making a dock at the site of the present Cumberland Basin. Nothing was done however until 1802 when, after a number of schemes had been discussed, it was decided to apply for powers to make a new course for the river from Totterdown to Rownham, and to turn the old course for a length of over 2½ miles into a wet dock with entrance locks and basin.

A Company was formed and an Act was obtained in 1803, the estimated cost of the works, including land, being £300,000. The works were completed in 1809; but, difficulties having been unexpectedly great, the total cost reached about £600,000. The work was an unprecedently great piece of

engineering for the period; it removed the greatest objections to the port of Bristol—the necessity of grounding vessels with the consequent liability to injury, and also the danger in case of fire from being unable to move vessels when aground—and provided a commodious wet floating dock of over 71 acres in extent for shipping. A description of the method of executing the work may prove interesting.

Dams were constructed across the river at Totterdown and near Rownham, the dam at the Underfall Yard being known as the "Overfall" and afterwards as the "Underfall." A dam was also made across the river at Netham. Between Netham and Totterdown there is a considerable bend in the river, and by making a straight cut from these points a saving in distance of over three-fifths of a mile was effected. That cut—known as the Feeder Canal—enables small vessels and barges to pass from the Avon above Netham to the Floating Harbour at Totterdown, and it also affords a means of supplying the Floating Harbour with water to compensate for loss caused by leakage and by the use of the locks and basins. A lock was made at Totterdown to allow of small craft entering the Feeder or Floating Harbour direct from the river.

On the new course of the river, mid-way between Totterdown and Rownham, an entrance lock and basin were made to accommodate vessels of the coasting class, and the basin was connected with the Floating Harbour by means of a junction lock; it was named Bathurst Basin in honour of one of the then members of Parliament for the city. The principal entrance to the Floating Harbour was constructed at Rownham. There the river made a sharp bend and a cut was made across that bend. The entrance locks, two in number, commenced at a point about 600 yards below the Overfall dam; then there was a Basin, 700 feet long by 300 feet wide, connected with the Floating Harbour by means of a junction lock. Subsequent alterations have almost entirely removed all traces of the old north entrance lock, and the south entrance lock was subsequently widened and altered to such an extent as to make it practically a new lock; the old junction lock still

remains, but it has been built up at one end so that it is not available for use.

The old course of the Avon between the junction lock and Bristol Bridge and the enlarged course of the Frome up to the Stone Bridge was suitable for vessels with masts; excluding the Merchants' dock, the area of these two portions of the harbour was about 57 acres. The portion of the harbour above Bristol Bridge has an area of about fourteen acres, and is suitable for barges and hulks.

Before the portion of the river now forming the Floating Harbour was "dockised," the mud that accumulated on the banks was removed by "freshes" in the river, or at other times, by sending men at low water to push the mud down the bank into the river; but, after the Floating Harbour was made, mud could no longer be removed in that way. The water in the river Avon and the estuary of the Severn is heavily charged with mud, and a great deposit takes place in the harbour near to the entrance locks. It is now removed by dredging, but when the Floating Harbour was made, dredging plant was in a very primitive state, and the harbour rapidly silted up near to the Basin. The harbour was closed from time to time to allow of the mud being scoured out, but it was found that the frequent closing of the harbour was detrimental to trade. Mr. I. K. Brunel, the celebrated engineer, was consulted and he made certain recommendations, namely: (1,) To divide the harbour into two portions at Prince Street, and to put a sluice in one of the abutments so that one portion of the harbour could be scoured without disturbing vessels in the other portion. (2,) To make a trench or culvert from the harbour to the river near to Cumberland Basin, so that mud deposited in the harbour near to the trench could be scoured into the river. (3,) To have a steamboat fitted with a scraper to stir up the mud and drag it to positions where it could be scoured away. The vessel is known as the "Dragboat."

The first method has been given up as the Floating Harbour is not emptied now, but the second and third methods are still in use.

In 1839, Mr. Brunel proposed to improve the course of

the river Avon and to make new locks at Cumberland Basin, or as an alternative, to construct docks at Sea Mills. He also proposed to make a floating pontoon pier at Portishead.

Mr. Brunel was then asked to design a new lock of larger dimensions, but constructed in such a manner as not to lessen the area of Cumberland Basin. Mr. Brunel designed a lock 262 feet long between the gates and 54 feet wide at the narrowest part, and he made the gates each in one leaf and turning on a hinge. It is claimed that these were the first gates made of wrought iron, and constructed so as to give buoyancy. These gates are of a peculiar shape and they are provided with air chambers, and large sluices for scouring purposes.

In 1847, the Corporation acquired the Docks from the Company. Some slight improvements were made by cutting off a few of the sharpest bends in the river. Various large schemes were proposed for the improvement of the port in one of three ways. (1,) Straightening and deepening the channel of the river. (2,) Constructing a new dock at the mouth of the river, and (3,) Dockising the river from Avonmouth upwards. In 1859, Mr. Thomas Howard, who was then the engineer for the Bristol Docks, gave a full report on dockising the river. He proposed locks and entrance basins on the Somerset side of the river at Wharf Point (that is, nearly opposite the Swash Channel) and a dam across the Avon nearly opposite where the outer gates of the entrance lock to the Avonmouth Dock are now situated.

After a discussion had taken place on the various plans that had been proposed the Corporation, on the first of October, 1859, resolved to ask Mr. (afterwards Sir John) Hawkshaw and Mr. Thomas Page to report as to the best means of improving the port of Bristol. The reports which they presented are dated the 25th July, 1860.

Sir John Hawkshaw, whilst stating that he considered dockisation practicable from an engineering point of view, considered it would be preferable to improve the river Avon by straightening, widening and deepening, and to construct a new basin and locks near Cumberland Basin.

He considered that even if the river were improved, vessels only of a limited size would come to Bristol, his words being: "I am not of opinion that by straightening, widening and deepening the Avon you will secure ocean steamers of the largest class coming to Bristol"; his main objection to dockisation was on account of the possible prejudicial effect on King Road that might be caused by the abstraction of the tidal waters of the Avon. He considered that the construction of the dam across the river would be a very difficult piece of work.

Sir John Hawkshaw's recommendations for the improvement of the river and the formation of a new basin and locks at Cumberland Basin, were estimated to cost over £900,000. Mr. Thomas Page, in his report, recommended the construction of basins and docks at Avonmouth. Neither of the recommendations were carried into effect.

Mr. Howard reported again on dockisation in 1879. He combatted the objections of Sir John Hawkshaw and Mr. Page and gave his reasons for considering that the dockisation of the Avon would not have an injurious effect on King Road. Sir John Coode was asked to consider the question, and he reported on the 18th March, 1883. He stated that from a careful examination of the "set" of the tides on the Bristol Channel, he was of opinion that the "continuance of the deep water along the shore and through King Road would be permanently assured by the momentum of the Severn stream, even if the whole of the tidal waters of the Avon were excluded by the erection of a dam as has been suggested."

Meanwhile, the Corporation resolved to take steps for the improvement of the river and the development of the Floating Harbour. An Act was obtained by the Corporation in 1865 for the improvement of the river, and for making new locks and alterations at Cumberland Basin. In 1866, the Great Western and the Bristol and Exeter Railway Companies obtained an Act for the construction of a railway wharf, and a railway between that wharf and Temple Mead Station. The Bathurst, Prince's, and Railway wharves were constructed about the same time, the length of quay

being about 3,200 feet. Several of the rocky points in the river were removed, and an entrance lock was constructed 350 feet long between the gates, and 62 feet wide, the depth on sill being three feet more than was provided at the old north entrance lock. A junction lock was also constructed of the same dimensions but of less depth. The inner sill of the junction lock is placed at such a depth that vessels drawing 22 to 23 feet can enter the harbour.

It was recognized that these works would be of great advantage to the port, but some of the prominent citizens being of opinion that provision should be made for accommodating a larger class of vessel than could navigate the Avon, promoted a Company for the formation of a dock at Avonmouth. An Act was obtained in 1864 and the dock was begun in 1868. The lock was made 454 feet long between the gates and 70 feet wide at coping level. The sill was formed at such a level as to give a depth on sill of 38 feet at high water of ordinary spring tides. The dock as constructed had an area of about sixteen acres. Considerable difficulties were experienced in constructing the dock, and it was not completed until 1877.

While the Avonmouth dock was being constructed, another Company obtained an Act for a dock at Portishead on the other side of the Avon, a little over two miles from Avonmouth. The lock is about the same length and width as that at Avonmouth, but has four feet less depth on the outer sill. A quay wall was constructed for a length of 1,800 feet on one side of the dock, there being no wall on the other side. The dock was opened in June, 1878.

A great competition took place between Bristol and the Avonmouth and Portishead docks and the effects were disastrous. It was felt that the city of Bristol should acquire the outside docks, if possible, and after long negociations Parliamentary powers were obtained, and Avonmouth and Portishead docks were transferred to Bristol in September, 1884.

Since then various schemes have been brought forward for the improvement of the port, the most important being a scheme for a low water pier at Portishead for transatlantic

liners and a dock at Avonmouth to accommodate the largest class of vessels. Parliamentary powers were sought for the latter work and the Bill passed a Committee of the House of Lords in 1893, but various difficulties having arisen the Bill was withdrawn before it reached the other House.

The whole question of providing for the accommodation of the largest class of vessels by docks or dockisation of the Avon was referred to the writer of this article, and he reported on the 2nd July, 1894. This report was referred to Mr. J. Wolfe Barry (now Sir J. Wolfe Barry, K.C.B., F.R.S.), and he reported in January, 1896. In October last, the Town Council resolved to promote a Bill for the construction of a large dock at Avonmouth, but it was found that it was too late to make arrangements with the Great Western and Midland Railway Companies, and the Bill was not proceeded with. The question is under consideration at the present time.

Since the Corporation acquired the outside docks, a large amount of money has been spent for river improvements and on new works, especially at Bristol and at Avonmouth dock. A scheme of river improvement is at present in progress and it is expected that when it is completed, large vessels will be able to navigate the river with greater safety, and that the period during which vessels will be prevented entering the river at times of neap tides will be considerably reduced. A number of improvements have been made in connection with the Floating Harbour. A large granary has been built at Prince's Wharf. A new harbour retaining wall has been constructed at St. Augustine's in a style harmonizing with the new St. Augustine's Bridge. By encroaching on the Floating Harbour the new line of wall has added from 20 to 26 feet to the width of St. Augustine's Parade, which is a most important thoroughfare. In continuation of that wall a new wharf wall has been constructed for a length of 1,670 feet, five transit sheds have been built on the quay behind and an 18-ton steam crane has been erected. The shed next St. Augustine's Parade has a tower at the north-west angle, and the north end is of an ornamental character so as to

add to the architectural effect in that neighbourhood. New roads have also been constructed at Canons' Marsh which have the effect of opening up a very important district.

Prince Street swing-bridge has been renewed and a new hydraulic engine house has been erected. Cattle lairs and cold stores have also been erected. An additional pontoon landing stage has also been constructed at the Hotwells, giving accommodation for two steamers. The question of floods has also been considered. At various times, but more especially in October, 1882, and March, 1889, great damage was done to property by the Frome overflowing its banks and flooding large portions of the city. At times of high spring tides the Floating Harbour is much below the level of the tidal water outside, and it forms a reservoir for the reception of the flood waters of the Frome. As the sluices have had to be closed for a long time (three hours and twenty-five minutes on one occasion), considerable difficulty has been experienced in regulating the level of the Floating Harbour. New culverts and sluices have been constructed at the Underfall yard, the course of the Frome has been widened and deepened, and a relief culvert has been made. The Malago, a stream on the south side of Bristol, discharging into the river Avon opposite Bathurst Basin, also gave a great deal of trouble. It has been widened and deepened and a new relief culvert has been made to the Avon, the length being about three-quarters of a mile.

When the new wharf was constructed at Canons' Marsh, it was thought that either the Great Western or Midland Railway Companies would connect the wharf with their railway system. At present, the Great Western Railway Company has connection with the Bathurst, Prince's, and Railway wharves on the south side of the harbour; and the Midland Railway Company has a wharf above Bristol Bridge at St. Philip's to which goods are taken by barge, vessels with masts not being able to pass the bridge. After the Corporation had approached both Companies at different times, the Great Western Railway Company at length agreed to promote a Bill for making a line to Canons' Marsh, and constructing a large railway depôt there. The

scheme was rendered possible by an agreement having been made between the Corporation and the Great Western Company for the construction of certain works on the south side of the Floating Harbour. The works comprise a railway from the Harbour Railway Wharf to join the Portishead Railway near Bower Ashton, on the south side of the river Avon. It will be made along the south side of the Cumberland Road on the site of the present towpath, and will cross the river Avon by means of a swing bridge below Clift House. Branch lines will also be made to the timber yards on the south side of the harbour, to Cumberland Basin, and to the south side of the river at Rownham, where it is proposed to erect coal-tips. The swing bridge over the Avon will have a clear width of waterway of over 85 feet and will be a combined railway and road bridge, the railway being on the lower and the road on the upper level. There will be a double line of rails, and the width of the roadway on the bridge, including footpaths, will be 31 feet. The bridge will be worked from an overhead signal house and will be moved by hydraulic power. It is expected that the weight of the moving portion of the bridge will be nearly 1,000 tons. The bridge will be supported on a ring of cast steel rollers, and there will be hydraulic arrangements for wedging it up at the ends. There will be two road approaches on the north side of the river and two on the south side, one leading to Coronation Road and the other skirting the west side of Bedminster Park and joining the Ashton Road at the bridge over the Portishead Railway. A swing foot-bridge is also to be constructed over the Avon opposite Greenway Bush Lane, nearly half-a-mile above the other swing bridge. It will be of the same span and will also be moved by hydraulic power. It is intended to make a new wharf in the Floating Harbour in front of the timber yards for a length of about 1,700 feet, so that vessels laden with timber will be able to discharge on to the wharf instead of lying alongside a sloping bank as at present and discharging on to rafts, etc.

The Great Western Line to Canons' Marsh will commence

by a junction with the other new line of railway on the north side of the swing bridge. It will cross the New Junction Lock by means of a swing bridge, after which it will pass through the Merchants' dock, part of which will be filled up, and it will then be made behind Messrs. G. K. Stothert & Co.'s yard to Mardyke Wharf; from there it will go to Canons' Marsh, the line being behind the Gas Company's premises. The depôt at Canons' Marsh will have an area of over nine acres. The Corporation is to extend the Canons' Marsh wharf in the direction of the Gas works for a length of about 950 feet, and is also to make a new road so as to give easy access to the new wharf and to the Railway Company's depôt. The Acts giving powers to carry out the works described were obtained last year by the Corporation and by the Great Western Railway Company.

Bristol had once a reputation for ship-building but not much is done now, although there are two yards at which small vessels are built, and one yard at which vessels of considerable size are sometimes built. Ship repairing is carried on at five yards, four having graving-docks and one a slipway.

At Avonmouth the dock has been extended, the extension being 800 feet by 180 feet. A large hydraulic coaling crane has been erected on the east side, and the ground on the west side of the extension has all been laid out for the timber trade. A floating pontoon dock has been constructed, and new transit sheds have been provided on both sides of the dock. On the west side there are three two-floor sheds, 321 feet long by 115 feet wide on the ground floor. There are hydraulic cranes in front of two of the sheds, and a hydraulic grain elevator in front of the other. Cattle-lairs and refrigerating chambers, a hydraulic engine house and pumping house, and extensive cold stores for provisions, etc., have lately been constructed. The lock at Avonmouth is capable of accommodating vessels 425 feet to 430 feet over all; but a caisson groove is in course of construction, to allow of a caisson being used for vessels of a larger size than can use the lock at present. When the work is

completed, vessels of 485 feet over all will be able to use the lock. A large granary is being constructed behind the transit sheds on the west side of the dock.

At Portishead, the dock was equipped with sheds by the Company, who also constructed a large granary which was completed in 1885, after the transfer of the dock took place. The lock has been improved, and several buildings have been erected in connection with the equipment of the dock.

A large number of men are engaged in the engineer's department. Including those at the River Improvement Works, the average number for the first half-year was 496, and for the second half 615.

The expenditure in connection with the docks charged to capital was, at the 31st December, 1897, as follows:—

Bristol, including the expenditure on river improvements	£1,166,354
Avonmouth	788,918
Portishead	273,200
Total ...	£2,228,472

The Sinking fund which is intended to redeem a portion of that capital was at the same time £137,118.

A more detailed account of the plant and of the various works that have been carried out in the last fourteen or fifteen years may be of interest.

River Improvements.

A considerable amount was spent up to 1890 in cutting off several points, including the Suspension Bridge Point, Round Point at Bridge Valley Road, and what was known as Tea and Coffee House Point on the opposite side of the river from Round Point and a little lower down. The writer of this article reported on further river improvements in April, 1895, and the work was authorised in 1896. The points are to be further cut away so as to give curves of a minimum radius of 1,800 feet, except at the Horse Shoe Bend, about 3¼ miles from Cumberland Basin. The water is deep on the concave side at that bend, and no difficulty is experienced except when two large vessels

pass. A signal station has been erected at Sea Mills, and a system of signals has been arranged with a view to obviate the necessity of vessels passing at the Horse Shoe Bend. Owing to the high ground and rock cutting, it was estimated that it would cost about £140,000 to cut through the bend. The bottom of the river is being cut so as to give a uniform slope of about 1 in 4,000, and the width of the channel is gradually increased from the entrance lock at Cumberland Basin down to Sea Mills. The usual slope of the banks is 1 in 4.

On commencing to remove a "point," the bank is excavated for a short length and the rock removed down to a level of about one foot above low water of ordinary spring tides, a flat surface thus being obtained for the barges used in connection with the work. Next a trench is cut to the depth required, so as to expose a face for the men to work upon, the trench being at right angles to the stream, its outer end extending into the course of the river; here a low water dam is made from stones and stiff mud, to keep the water out of the trench at times of low water when the men are at work; a steel barge is also provided for each trench, the barge being fitted with a 15-inch centrifugal pump, and a 5-ton steam crane and a large boiler.

The pump suction pipe has swivel bends and joints which enable it to project from the barge into the trench at any required angle; the pipe is also arranged so that it can be quickly lifted into position by means of the crane and connected to the pump. As the tide falls, the barge is carefully grounded so as to lie close along the side of the trench; the suction pipe is lifted into position and connected to the pump and, as soon as the tide falls below the level of the dam, pumping commences and is completed in about fifteen minutes; work is then begun on the rock, which is removed by blasting, powder being used for the dry holes and gelegnite for the wet holes.

The men stack up the smaller stones and soft material behind them as the rock is removed from the face, thus keeping the trench no wider than is required for the men to work in, the object being to have as little water as

possible to pump out on commencing work at each tide. Rock drills are driven from an air compressing installation on the river bank below Round Point, pipes being carried across the river and along the river banks.

The soft material and smaller stones have afterwards to be removed by dredging; the larger stones are lifted by the crane direct into a barge alongside the crane barge, three crane and pumping barges being provided so that work can be going on in three trenches at the same time if required. "Wells'" lights are used for night-work. Over 150 men are employed and the work is tidal, the men working at low water twice a day, the usual time being about four hours at each tide.

Dredging and Dredging Plant.

As has already been said the water of the Avon is heavily charged with mud. Were it not for that, little dredging would have to be done in the Floating Harbour; owing, however, to the entrance of muddy water when the lock gates are opened, dredging has to go on almost constantly between the Junction Lock at Cumberland Basin and Mardyke Wharf. For the same reason, a considerable amount of dredging has to be done in the Harbour near to the Junction Lock at Bathurst Basin, but the quantity is not one-fifth of that near Cumberland Basin. During the last six years the average annual quantity dredged from the Floating Harbour has been about 288,000 tons. Of that quantity, about a tenth part was taken by the Hopper Dredger "B.D. 1" to the depositing ground near the Denny Island in the Bristol Channel, the remainder being passed into the river by the culvert at Underfall Yard. At that yard, the Floating Harbour is separated from the river by a narrow strip of land about 70 yards wide, which was made to form a dam across the old course of the river. A large culvert 7 feet by 6½ feet, the bottom of which is about 23 feet below the level of the Floating Harbour, runs from the harbour to the river. It is provided with a double acting sluice worked by hydraulic power. When dredgings are to be sent into the river,

a hopper barge is brought alongside the harbour end of the culvert at time of ebb tide. The sluice is partly lifted so as to cause a run of water through the culvert towards the river, and, at the same time, the hopper doors are lowered and the dredgings are swept through the culvert. During the last six years probably about 300,000 to 400,000 tons were dredged at the new wharves and in deepening the harbour, the remainder being due to deposit. When the dredged materials are discharged into the river the stone and gravel deposit in the bottom of the river between Underfall Yard and Rownham Ferry. This is dredged again and the materials are used as ballast for roads, railway lines, foundations, etc. The average quantity obtained in this way during the last three years has been about 4,500 tons.

Except in the vicinity of the entrance lock at Cumberland Basin, little dredging is done in the river, but when the river improvements are completed considerable dredging will be necessary in order to maintain the enlarged channel. The tidal scour maintains generally the width and depth of channel, but during long periods of drought considerable deposits of silt occur. A "fresh" in the river is of the utmost value in clearing that deposit away.

At Avonmouth and Portishead dredging has to be done inside the docks and at the entrances. At the present time the Hopper dredger "B.D. 1" is engaged in widening the Swash Channel, which forms the entrance to the river. All the dredging to these docks and entrances is done by the "B.D. 1," and the dredgings are all deposited near the Denny Island. During the last six years the average annual quantity dredged has been about 180,000 tons, part being due to the extension of Avonmouth dock and to the deepening of Portishead dock.

Granaries.

As grain forms the most important article of import to the port of Bristol, a number of sheds and granaries have been provided for its reception. In addition, there are several private granaries in Bristol. During the last three

years (ending 31st December, 1897), the average import of grain into London, Liverpool, Hull and Bristol has been as follows :—

	London.	Liverpool.	Hull.	Bristol.
Wheat, in qrs.	2,837,396	4,613,882	2,989,870	1,059,156
Barley „	948,669	390,172	645,260	1,271,500
Maize „	1,411,301	3,170,718	625,788	754,932

It will thus be seen that Bristol takes the first place as a barley port.

At Bristol, a large granary has been constructed at Prince's wharf. It is a substantial brick building, 232 feet 6 inches long by 99 feet wide by 97 feet high to apex of roof. There is a central hauling way through the building, 26 feet wide, with cross hauling ways at intervals. Above the ground floor there is a loading platform arranged for loading into railway truck or cart. The first grain floor is fire-proof, and there are six other grain floors and on the top there is a machinery floor. The building above the fireproof floor is divided into two by a strong brick wall. There are lines of rails both at the front and back of the building, and hydraulic capstans are provided for moving the trucks. The building will hold nearly 70,000 quarters of grain.

At Avonmouth, the Dock Company constructed a granary, 150 feet by 65 feet by 58 feet high, capable of holding about 25,000 quarters, and the building was provided with an elevator and one longitudinal conveyor band. In addition, there is accommodation for a large quantity of grain in the various sheds. At present, a large granary is in course of construction on the west side of the dock. The building will be parallel with the dock, and at a distance from it of about 200 feet.

At Portishead, there is a large granary, 365 feet long, 70 feet wide and 44 feet high; it is about 145 feet from the dock. Grain is conveyed from the dock to the top of the granary by four conveyor bands, which are at a slope of one in four. There are two longitudinal conveyor bands at the top of the building. The bands are worked by steam power.

Floating Pontoon Dock.

The Pontoon dock at Avonmouth was completed in 1894. It is 365 feet long and 85 feet wide and, allowing for an overhang at each end, it is capable of taking a vessel of about 410 feet over all. It has a lifting capacity of 4,200 tons, and the dock itself when pumped out weighs about 2,700 tons; that includes about three inches of water in the pontoons. It consists of six rectangular pontoons, 8 feet 6 inches deep at the centre, on which are bolted side chambers and girders which serve the purpose of supporting the pontoons when submerged, of containing the pumping machinery and of connecting together the pontoons and distributing the stresses; any of the pontoons can be taken out and docked on the others for painting or repairs. Each pontoon is divided into eight compartments by bulkheads, and the pipes and valves are so arranged as to enable each compartment to be pumped out independently of the others, if considered necessary. On the top of the side girders are placed the valves, etc., for manipulating the floating dock. The pumping machinery comprises four centrifugal pumps, each capable of discharging 1,000 tons of water per hour, four marine boilers each 6 feet 6 inches diameter, and six small pumps of the "Duplex" type for drainage and feed water purposes.

Lairs, Chill Rooms and Cold Stores.

The importation of American and Canadian cattle constitutes an important and successful branch of the Bristol trade. The regulations of the Board of Agriculture require that all cattle shall be landed and kept within a prescribed area, and further, that all are to be slaughtered on the premises within ten days of their arrival. At Bristol, a landing-place and cattle-lairs, suitable for accommodating 550 head of cattle, are provided on the north side of the Junction Lock at Cumberland Basin. There are also at the same place large slaughter-houses and two chill-rooms. The chill-rooms are at present capable of accommodating 200 sides of beef, but they could readily be extended, when required, to take twice that number.

At Avonmouth, a cattle landing-place and lairs are provided on each side of the entrance lock, capable of accommodating 700 head of cattle and 4,000 sheep. There are also eight slaughter-houses and three chill-rooms capable of taking 700 sides of beef; the chill-rooms can be readily extended if necessary. The refrigerating machinery is of Messrs. Pontifex & Wood's ammonia absorption type, and has been in operation since 1889.

During the past year a very complete cold storage installation has been completed for the reception of American and Canadian provisions at Avonmouth dock. This consists of six large rooms of a collective capacity of 110,000 cubic feet.

Hydraulic Machinery, Cranes, Etc.

There are two hydraulic engine houses, one being at the Underfall yard, Bristol, and the other at Avonmouth.

In each case the machinery is practically the same, and consists of two hydraulic pumping engines of the "Worthington" type. The engines are compound surface condensing with steam cylinders 17½ and 30 inches diameter, and 30 inches stroke; the pump rams are 7 inches diameter, and each set of pumping engines is capable of delivering 700 gallons of pressure water per minute at a pressure of 750 lbs. per square inch. Steam is supplied by three Lancashire boilers, the feed water being heated by a "Green's" Economiser. There are also large accumulators.

At the Underfall yard there is a slipway belonging to the Corporation, and vessels are pulled up by means of a rotary hydraulic engine. At Avonmouth and Portishead there are centrifugal pumps for maintaining the level of the water in the docks, and there are seven locomotives belonging to the Corporation which are used for working the railway traffic. At Avonmouth, there is a 15-ton hydraulic crane and a large hydraulic coaling crane. It is capable of being moved along the rails; a cradle to carry the truck is provided, and so arranged that it can be clamped to the top of the rails anywhere within the radius of the crane; the truck of coal is drawn up ramps on to the cradle by a hydraulic capstan, cradle and truck are then lifted to a

height so as to clear the vessel's bulwarks, etc., and then the load is swung over the hold and lowered as close down as possible; the crane then tips up the truck of coal by lifting one end of the cradle, and the operation is complete. The crane can also be used for general purposes up to a weight of 35 tons.

Flood Prevention Works.

Reference has already been made to the damage done by floods in the river Frome. That river drains a district lying to the north-east of Bristol, the drainage area being about 68 square miles. The channel of that portion of the river within the city boundaries as it existed before the recent extension, was encroached upon by buildings, and for a length of about 630 yards above the Stone Bridge (where it joined the Floating Harbour) it was arched over, the sectional area being very irregular and at places greatly contracted; while the open portion of the channel was too contracted, the covered portion was considerably worse in that respect. The consequence was that when a heavy and continuous rainfall took place the river was dammed up above the covered portion and overflowed its banks, flooding portions of the city. In October, 1882, the flooded area within the city was about 125 acres; and in March, 1889, it was about 200 acres; the quantity of water penned up being estimated at about forty million cubic feet. An Act was obtained in 1890 which gave power to improve the channel of the Frome, and to make a relief culvert from Stapleton (above Bristol) to the Avon at Black Rock (below Bristol), the length of the culvert being about 3¼ miles. It was estimated that the culvert would be capable of discharging about six million cubic feet per hour into the river Avon. The channel of the Frome was greatly improved; a short relief culvert was made from the Frome at Broad Weir to the Floating Harbour above Bristol Bridge, and new culverts and sluices were constructed at Underfall yard for dealing with the flood waters in the Floating Harbour. There are four culverts with a united area of 180 square feet, and

each culvert has a double acting brass faced sluice worked by hydraulic power. The Stapleton Black Rock Culvert has not been made.

In November, 1894, there was a very heavy rainfall and great damage was caused by the Avon at Bath and other places, the quantity of flood water coming down the Avon being probably as high as that of any previous flood of which there is any record. The channel of the Frome, owing to the improvements which had been made, was found at that time capable of discharging all its flood water with practically no flooding. The writer made careful calculations and, as a result, estimated the maximum discharge at about nine million cubic feet per hour. The quantity of flood water which came down the Frome in March, 1889, was considerably greater and was estimated by the writer at about ten-and-a-quarter million cubic feet per hour. He reported on the whole question on the 18th March, 1895, and recommended as an alternative to the Black Rock culvert scheme, the construction of a reservoir at Stapleton to take the surplus water over nine million cubic feet per hour, which could be taken by the channel of the Frome. As nine million cubic feet per hour would, at times of high tide, be in excess of what could be stored in the Floating Harbour, without detriment to the shipping interests, he also recommended the construction of a pumping station. It was proposed to have eight 57-inch centrifugal pumps which, with the low lift necessary, would be capable of discharging five million cubic feet per hour. The necessary powers have not yet been obtained.

In connection with the proposal to dockise the Avon by means of a dam across the river at Avonmouth, the floods question is a most important one. The total drainage area of the Avon and tributaries is nearly 900 square miles, and the flood discharge has been as high as about sixty million cubic feet per hour. Supposing dockisation an accomplished fact and a maximum flood discharge occurring at high water of spring tide, it would be necessary to lower the water in the river so as to provide a reservoir for the flood waters while the sluices were closed. The water would

rise in the river, and on certain tides the range of level might be as much as from 10 to 14 feet.

Tides.

The tides in the Bristol Channel are of great interest, as they attain a much greater height than in any other estuary in this country. The entrance to the Bristol Channel is very wide, and the width diminishes in a fairly regular manner, so that the estuary may be considered funnel-shaped. A large quantity of water enters with the tidal wave, and as the sectional area of the channel diminishes the water is heaped up, and the level of high water gets higher as the distance from the entrance increases. At high spring tides observations were taken simultaneously at Cardiff, Avonmouth and Sharpness, and it was found on the average of two observations that high water at Avonmouth was 2½ feet higher than at Cardiff, and 2¼ feet less than at Sharpness. At Avonmouth the average level of high water when these observations were taken was 24·55 feet above ordnance datum (which is 15·58 feet above the outer sill of Avonmouth Lock). The highest tide of which there is any record occurred on the 17th October, 1883, and rose at Cumberland Basin to 29·1 feet above ordnance datum; at Avonmouth it was somewhat less. It rose 3 feet above the predicted height of that tide at Cumberland Basin. Fortunately at high spring tides the actual height is scarcely ever more than 2½ feet above the predicted height, the difference of 3 feet being altogether exceptional. During the last twelve years the difference has only exceeded 2½ feet on two occasions. At neap tides the variation is greater, as much as 5 to 6 feet above the predicted height having occurred. The difference in the level of high water of spring tides and that of neap tides is very remarkable. High water of neap tides is sometimes as low as 6 to 8 feet above ordnance datum, giving a range in the level of high water of about 21 to 23 feet. The level of high water is affected by the strength and direction of the wind and by the atmospheric pressure, a high barometer lowering the tide and *vice versâ*. A rise of one inch in

the barometer causes a depression in the tide of about fourteen inches.

Low water is subject to the same variations as high water. At the mouth of the Avon, low water of ordinary spring tides is taken as 19·08 feet below ordnance datum and high water as 22·42 feet above, so that the range is 41·50. At equinoctial tides low water may be from 2 feet to 3½ feet lower, but the latter level is very exceptional. At neap tides, counting an ordinary neap tide as 10 feet below an ordinary spring tide, low water is taken as 11½ feet below ordnance datum, but at times of low neaps it may only be 6 or 7 feet below. The difference of level at Avonmouth between high and low water is sometimes as great as 49 or 50 feet. The diagram on opposite page shows an equinoctial tide, a medium tide, and a low neap tide.

At certain states of the tide, the current in the deep-water channel off Portishead runs at from 5 to 6 miles an hour, and sometimes at a higher velocity. Observations were taken by the writer in 1895 for Sir J. Wolfe Barry, and the highest velocity obtained was 6¼ miles an hour. The velocities were calculated for a length of 1 mile, and the highest velocity occurred on the ebb at half tide. The results of the observations as regards both direction and velocity are shewn by a diagram in Sir J. Wolfe Barry's report of 28th January, 1896. In the Avon the velocity is much less, about 3 miles an hour being the maximum.

One interesting feature in the Severn is the tidal bore, a phenomenon that occurs in several rivers in Great Britain, notably the river Trent and the Solway Firth; but the best known is that of the river Severn. Mr. Scott Russell, who carefully investigated the subject of tidal propagation, states that "a tidal bore is formed when the water is so shallow that the first waves of flood move with a velocity so much less than that due to the succeeding parts of the tidal wave as to be overtaken by the subsequent parts, or whenever the tide rises so rapidly that the height of the first wave of the tide exceeds the depth of water at that place."

In the Bristol Channel at the mouth of the Avon the level of low water of ordinary spring tides, as already

Ft
30
25
20
15
10
5
0
5
10
7.58
Ordnance Datum
O.C.B Datum
33.0
26.0
17.0
Scale 3/32" - 1'
0
10
20
30
40 Ft
1 hour
2 hours
3 hours
4 hours

mentioned, is taken as 19·08 feet below ordnance datum. Admiral Beechy in his "Remarks upon the Tidal Phenomena of the River Severn," based upon a survey made in 1849, gives the level of summer low water at Sharpness as 2·79 feet below ordnance datum. At Hock Cribb, about 7½ miles higher up, as 6·55 feet above ordnance datum; at Framilode, 8½ miles from Hock Cribb, as 15 feet above datum; and at Rosemary Point, 4 miles from Framilode, he gives the height as 16·62 feet.

The width of the Severn estuary at high water is very variable, being 5¼ miles at Avonmouth; 2 miles at New Passage; 1 mile at Aust Cliff, opposite Beachley Pier, which is about 2½ miles above New Passage; and at Inward Point which is nearly 4 miles above New Pasage, the width is 2¼ miles. Above New Passage at low water or at half tide the channel is comparatively narrow, and is obstructed by many sandbanks.

The bore first makes its appearance between Inward Point and Guscar, about 7 miles above New Passage, but it spends itself upon the sands above Guscar. It is next seen higher up near Sharpness; but it is not until it reaches the neighbourhood of Brimspill, about 3 miles above Sharpness, that it reaches a considerable height. From there the height increases, attaining a maximum between Newnham and Stonebench. Then it diminishes until it reaches Gloucester, where it is stopped by the Llantony and Maisemore Weirs.

The bore is greatest at spring tides, its height depending upon the magnitude of the tide. Its speed is affected by the strength and direction of the wind, the nature of the river bed, and especially by the sandbanks in the river. Admiral Beechey gives the rates of the bore as follows:—

	GEOGRAPHICAL MILES PER HOUR
From Beachley to Sharpness	3·7
,, Sharpness to Hock Cribb	5·8
,, Hock Cribb to Newnham	4·7
,, Newnham to Framilode	8.1
,, Framilode to Rosemary	5.2
,, Rosemary to Stonebench	13.7
,, Stonebench to Haw Bridge	12·22
,, Haw Bridge to Upton Bridge	8·1

Framilode is a very favourable position from which to see the bore. From particulars taken by other observers, the bore at Framilode appears to proceed at a faster rate at times of high spring tides than that mentioned by Admiral Beechey, a rate of 11 to 12 miles an hour having been found by actual measurements.

Admiral Beechey states that at a high spring tide in December, 1849, when the river was 2 feet above ordinary summer level and the morning was calm and favourable to the phenomenon, the bore came rolling up the river with a breast from 5 to 6 feet high at the sides and 3 feet 6 inches in the centre. The observation seems to have been taken from Stonebench. He states that with a fresh in the river the sandbanks, which are usually dry and prevent the bore attaining a high velocity, are covered, and the velocity of the bore is much increased. He found that the increase was as much as from 4 to 10 miles an hour, the 4 miles being at summer level and 10 miles at times of fresh.

THE PORT OF BRISTOL.

THE Port and Harbour of Bristol extends from Hanham Mills, on the river Avon, to its mouth at Kingroad, thence down the Bristol Channel westwards to the Steep Holmes, and in a straight north east direction therefrom to Aust Cliffs, on the banks of the Severn, twelve miles above Kingroad.

From time immemorial the Mayor, Aldermen and Burgesses of the City have been owners of the Port of Bristol, and entitled to receive dues on the Shipping resorting thereto and the goods conveyed therein, and have also been conservators of the river within the Port.

Situated as the ancient city is at the head of the great estuary of the Bristol Channel, which runs up towards the middle of the southern half of England, it possesses, with its excellent docking facilities, accommodation for very large vessels at Avonmouth and Portishead, and for moderate sized vessels at Bristol, thus affording great advantages for the economical distribution of sea borne commodities among the thickly inhabited mining districts of South Wales, and the large industrial and agricultural centres in the Midland and Western Counties, and for the export of minerals and manufactured goods therefrom.

The present Dock system within the port comprises a dock of 19 acres at Avonmouth on the Gloucestershire bank of the Avon, one of 12 acres (deep water area) at Portishead on the Somersetshire bank of the river two miles below Avonmouth, and a floating harbour of 70 acres in the heart of the City of Bristol, six and a half miles above the junction of the Avon with the Severn, or upper portion of the Bristol Channel. The two former docks, which were constructed by private Companies for the special accommodation of the larger class of vessel which could not be safely navigated up the Avon to Bristol owing to the sharp curves and narrow channel, were purchased by the Corporation of the city of Bristol, and came under their

control on the 1st September, 1884. There is also a pontoon graving dock at Avonmouth, and several dry docks at Bristol available for the repair of large vessels.

The history of the Floating Harbour, or, as it is now termed, the City docks, is as follows. They were formed by a private Company in 1807-1809, by the conversion of about three miles of the then tidal river Avon into a floating Harbour, a new channel for the river having been cut to the south of the city, and were opened for public traffic in the latter year. The harbour thus formed comprises about 70 acres of water or dock space, surrounded by offices and warehouses both public and private in the heart of the city, the total area dammed up and kept level being about 85 acres.

Owing to the high tariff of dues in force from the opening of the City docks till 1847, and the failure to carry out the new works necessary to accommodate the increasing size of vessels then beginning to be employed in the foreign trade of the United Kingdom, a policy due chiefly to the impecunious state of the Docks Company, the trade of the port suffered grievously, and indeed was well nigh stagnant, but after considerable agitation by the traders and merchants an Act of Parliament was obtained in 1847 whereby the Corporation obtained possession, with a compulsory condition to reduce the rates on both vessels and goods, but with the power to supplement any deficiency in the dock revenue caused by so lowering the tariff by levying a rate in aid up to 4d. in the pound on the rateable value of the city.

Under these powers the dues were lowered from two-thirds to one half in the year 1848, and many harbour improvements carried out, the result being an increase by 1870 in the foreign tonnage from 129,254 to 355,921, and in the coastwise tonnage from 513,463 to 593,130. Under Parliamentary powers obtained by the Corporation in 1865, great river and harbour improvements have subsequently been effected; several sharp bends which formerly existed in the Avon have been removed and many barriers of rock in its bed cleared away, larger and deeper locks have been constructed at Cumberland Basin, a considerable

length of deep water wharf contiguous to the Great Western Railway system on both sides of the harbour has been constructed, and a complete system of foreign animals' wharves, slaughter houses, chill rooms, granary, transit sheds, warehouses and hydraulic cranes have been provided.

By reason of these new works and the further works now in progress, vessels of 320 feet length and 55 feet beam, with a carrying capacity of 3,000 to 4,000 tons, are able to come up without delay from Kingroad, navigate the river Avon, and enter the City docks at high water on all ordinary tides throughout the year; and when the whole scheme of improvements is completed, as is anticipated by July, 1899, vessels of even greater lengths and capacity will find accommodation, and there will be less detention in Kingroad when such vessels happen to arrive on neap tides. Meanwhile, the foreign shipping trade of the old City docks, nothwithstanding the opening of the Avonmouth docks in 1877, and the Portishead dock in 1880, has increased from 355,921 register tons in 1870 to 549,493 register tons in 1897, and the coastwise tonnage from 593,130 to 681,835. In addition, the Avonmouth and Portishead docks in 1897 developed a foreign tonnage of 268,591 and a coastwise tonnage of 73,596 tons.

The total shipping import trade of the port in 1897 attained the respectable figure of 1,573,515 tons—a striking commentary on the wisdom of the policy adopted in 1847, and again in 1884, of purchase by the citizens of all private rights in the dock property within their port, and of their consent to taxation to the extent of 4d. in the pound in the event of the revenue from dock sources proving inadequate to meet the dock expenditure after lowering the tariff.

The dock estate comprised as above stated of the Avonmouth, Portishead, and City docks, is now worked under the direction of a Committee of the Town Council elected annually and consisting of nineteen members of that body. In addition to dock management, the Committee is charged by the Council with the general supervision of the city quays and sheds, and the dues received therefrom, and also all conservancy matters connected with the port of Bristol.

As regards the financial result to the citizens, it may here be pointed out that whilst for the first thirty years subsequent to 1848—the date of their taking over the City docks from private owners—they had to contribute £8,000 to £12,000 a year towards its revenue by rates-in-aid, yet on the other hand very large sums were during this time expended out of the dock revenue, so supplemented, on new works and improvements, which besides enormously increasing the trade and prosperity of the city, have also had the effect of increasing the revenue from its ancient inherited city dues on shipping and goods from £8,232 in 1847 to £25,328 in 1897.

To judge of the financial result correctly the dock accounts and those in respect to the city dues and quays must be taken together, and an account in this form is now submitted to the Council annually. In 1897 it appears that after paying all ordinary expenditure for maintenance, and no less than £9,078 for extraordinary outlay on reconstruction of old works, there was a sufficient balance left to pay 4·21 per cent. on the outstanding capital of the dock estate amounting to £2,184,167.

After paying interest on capital, £3,851 to Depreciation account, and £8,317 to a sinking fund which will redeem a large portion of the dock debt in fifty years time, there was a credit balance of £3,009 carried forward at the end of the financial year ended 30th April, 1897. It may here be pointed out that the rateable value of the city has increased from £437,725 (old limits) in 1851, to an estimated value for the same limits of 1897 of £1,153,311, and the commercial progress which these figures indicate is no doubt largely due to the dock policy which the Corporation has pursued.

The port of Bristol, in view of its excellent geographical and maritime position, and its direct railway and canal communication from the ship's side to all the leading centres of commerce, possesses great advantages for the distribution of imported goods and the collection of export traffic. Four of the largest systems of railway, *viz.*, the Great Western, the Midland, the London and South Western, and the

London and North Western companies, have access to its docks. By means of the special quick trains which are run over the two former lines, dead meat and perishable goods are delivered direct, *ex* liners, into the central London meat market in 4 hours, and into Birmingham in 3 hours, after being loaded up in Avonmouth dock.

By the fine weekly service of large fast vessels now being run by Messrs. Elder, Dempster and Co. between Montreal and Avonmouth, and Boston and Avonmouth, and by Messrs. Charles Hill & Sons, between New York and the City docks, a considerable expansion is taking place in the American and Canadian trades in horses, cattle, sheep, grain, flour, provisions, leather, wood pulp and timber.

The Bristol Steam Navigation Company have a first-class regular line of steamers between Bristol and Amsterdam, Antwerp and Rotterdam, while Messrs. Palgrave, Murphy and Co. have an excellent service to and from Hamburg. In addition to these lines there is also regular steamship communication with the Continent between Bristol and Boulogne, Charente, Rouen, Bordeaux, Cadiz, Lisbon and Oporto, as well as with the Channel Islands.

There is also a good regular service of coastwise steam liners between Bristol and Belfast, Glasgow, Liverpool, Hull, Plymouth, Southampton, London, Cardiff, Newport, Swansea, Barry, and all the South Wales ports, by which an ever increasing volume of goods imported from foreign ports by the direct liners, and intended for export by them, are distributed and collected. A large traffic is also carried on in horses, cattle, sheep and pigs from the southern Irish ports, Bristol being the chief supply depôt for store beasts for all the grazing districts in the south, south-west and eastern counties. To facilitate this coastwise traffic, for which the railway companies are always keenly competing, further extensive works are now in progress, points are being cut off and the channels straightened and deepened, and a system of lights and beacons are being provided whereby the navigation of the river, both by night and day, will be rendered practicable for longer periods of the tides than at present.

As regards imports, Bristol early possessed, and continues

to enjoy, a large share of the grain, flour and provision trade of the United Kingdom with Canada and the east and west coasts of the United States; also in the trade with South America and the Black Sea ports. Bristol is also a large importer of oils, seeds, marble, ores, green and dry fruit, esparto grass and valonia from French, Spanish, and Mediterranean ports, of hides and tallow from South America and the Baltic, timber and deals from Canada and the Baltic, mineral oils in bulk from the United States, and beet sugar and general goods from French, German, Belgian and Russian ports. Of late years a considerable general trade by regular liners, chiefly in sugar and manufactured goods, booked to inland towns in the United Kingdom on through bills of lading from the Continent, has been developed, and with the increased quay, shed and rail accommodation now being provided at the old City docks, this traffic may be expected shortly to attain far larger dimensions.

Avonmouth dock is chiefly used by the larger Canadian and American liners, also for whole cargoes of grain from South American and United States ports, and for the United States mineral oil trade, which latter is conducted in tank vessels of 5,000 tons capacity; Portishead dock is almost wholly used for whole cargoes of grain, chiefly from Black Sea and Argentine ports, and for naphtha from the United States.

As regards discharge of vessels and storage of goods at Avonmouth and Portishead docks, the labour and storage is nearly all performed by the Corporation for shipowner and merchant respectively, but all the operations at the City docks, except at the granary berth, are done by the shipowners or merchants themselves. Where the work is performed by the Corporation, the rates charged cover little more than the actual cost incurred, including shunting. As a whole, the cost of handling and storing cargoes at the port of Bristol is lower than elsewhere. In addition to the storage provided by the Corporation at each dock, there is extensive private warehouse accommodation in Bristol for grain and all other classes of goods.

Owing to the considerable expansion now taking place in the Canadian Trade at Avonmouth, and the greatly increased and increasing size of vessels now employed therein, the Corporation are contemplating the construction, at an estimated cost of about 1½ millions, of another dock at Avonmouth of about 40 acres in extent, with a lock 850 feet in length, having direct access from the sea, with 5,200 feet of quay fitted with commodious transit sheds, granary and graving dock, suitable for the reception and discharge with great dispatch of the largest class of ocean-going vessels afloat or building, and capable of extension if so required hereafter.

If, as undoubtedly was the case, the opening of Avonmouth and Portishead docks in 1880 and the carriage of goods therefrom by the railway companies at the same rates to inland places as from Bristol gave a great stimulus to the revenue and traffic of the port, both foreign and coastwise, by reason of the much larger and more economical class of vessel which shipowners were thus able to trade in, and the cheaper freight and wider area of distribution which merchants thereby secured, the greater seems the probability now, that the far larger scheme of dock extension contemplated by the Corporation, will, subject to the hearty co-operation of the railway companies who will get direct access thereto, have a similar result in these days of vastly increased and still increasing size of vessel, used more especially in the North American trade, which forms three eighths of the whole foreign trade of the port of Bristol.

The more rapid the vessel, the more frequent and punctual the sailings, and the cheaper the ocean and inland railway freight, the wider is the area which can be served *viâ* Bristol. If the Liverpool level of sea freight and passage and better railway rates to Birmingham and London could be secured by Bristol merchants, undoubtedly a far larger proportion of the supply of necessaries from Canada and the United States to London and the great manufacturing towns in the Midland counties would be brought by this route. It has been proved during the current season that much larger cargoes than was formerly

thought possible can be absorbed by Bristol merchants, and there is every reason to believe that the greater the facilities which can be given to accommodate and distribute such cargoes, the faster will be the progress in the traffic and revenue of the dock estate.

As regards Exports, now that the direct line from the Severn tunnel to Avonmouth is nearly completed, thereby shortening the transit of coal from South Wales collieries by 9 miles, there is good reason to believe that the efficient coal tip already erected at Avonmouth will be extensively used, and that vessels will often find it to their advantage to take in coal for both cargo and bunker purposes, rather than incur the delay and risk of seeking it at ports on the other side of the Channel. Again, given only punctual sailing of regular weekly liners, there seems no reason why with equally favourable railway shipping rates as now quoted to other ports, shipments of a fair share of the Birmingham and Wolverhampton hardware and pottery, and the Yorkshire and Lancashire wool and cotton goods to Canadian ports should not be made *viâ* Avonmouth just as well as *viâ* Liverpool. In addition, there are available for export feld spar, coal, china clay, salt, besides many local manufactured goods, such as railway material and wagons, wire, galvanized iron, tin plates, oils, spirits, chemical products, tobacco, confectionery, boots and shoes, millinery, clothing, etc.

The following tables shew the growth of the trade of the port of Bristol during the last five decades: –

NET REGISTER TONNAGE OF VESSELS FROM FOREIGN AND COASTWISE.

1850	.. ..	643,217	1877	.. ..	1,107,653
1857	.. ..	677,622	1887	.. ..	1,301,805
1867	.. ..	819,710	1897	.. ..	1,573,515

IMPORTS OF PRINCIPAL GOODS TO BRISTOL FROM FOREIGN PORTS.

	GRAIN. Qrs.	FLOUR. Tons.	MINERAL OIL Tons.	OIL CAKE. Tons.	SEEDS. Tons.
1867	521,600	809	337	2,601	1,388
1877	1,211,867	9,065	11,537	23,631	8,796
1887	2,367,797	38,998	20,922	38,385	14,266
1897	3,560,520	74,064	54,422	22,996	43,445

IMPORTS OF PRINCIPAL GOODS—*Continued.*

	SUGAR. Tons.	DEALS. Stds.	TIMBER. Tons.	VALONIA. Tons.	AMERICAN PROVIS'NS Tons.
1867	83,396	17,384	25,867	5,900	824
1877	67,744	32,681	45,115	7,521	4,884
1887	59,668	26,912	9,933	5,176	15,623
1897	71,408	38,465	25,924	4,012	39,510

	GREEN FRUIT *(Boxes).*	LIVE ANIMALS. Cattle.	Sheep.
1867	86,495	Nil.	Nil.
1877	59,271	Nil.	Nil.
1887	71,035	9,016	11,995
1897	132,730	19,129	6,864

REVENUE FROM DOCK AND CITY DUES ON ALL VESSELS AND RATES ON ALL GOODS.

1849	£36,931	1877	£69,289
1857	35,739	1887	80,865
1867	43,238	1897	115,449

In respect to the future it may be safely predicted, judging from the past history of the port and its splendid geographical advantages as a distributing centre, that if the railway companies will give low rates for through goods and the citizens provide further suitable accommodation according to the requirements of the traffic together with all modern facilities for ensuring rapid handling and storage of goods, the port will not only retain but in all probability greatly extend its present volume of trade, that carried in the largest type of vessel being provided for at the mouth of the river, and that in smaller vessels at the City docks.

BRISTOL COMMERCE AND INDUSTRIES,

By JOSEPH HOLMAN and HENRY J. SPEAR
(President) *(Secretary)*.
To the BRISTOL CHAMBER OF COMMERCE.

Commerce.

"Commerce flourishes by circumstances precarious, contingent, transitory, almost as liable to change as the winds and waves that waft it to our shores."—*Colton.*

Industries.

"To meditate, to plan, resolve, perform,
Which in itself is good—surely brings
Reward of good no matter what be done."
Pollock.

SINCE the last visit of the British Association to Bristol in 1875, the growth of the City has been characterized more than in any preceding period by the development of industries and the growth of commerce—everywhere there has been unparalleled progress. The tide of industry may be said to have changed the whole material aspect of the City and its surroundings.

Last year—the Queen's Diamond Jubilee year—very properly inaugurated the extension of Bristol's boundaries, thereby placing the City in the foremost ranks of the commercial centres of the United Kingdom. It is now sixth in the Kingdom in point of population; fifth for rateable value; seventh for area; and third in its contribution to the National Revenue. Further striking evidence of the extensive development of Bristol's commerce is given in the amount of Customs Revenue received at Bristol. In 1875 it amounted to £801,344, in 1897 to £1,877,308; being an increase of £1,075,964. The Inland Revenue taxes, excise and stamps are also close upon one million sterling per annum. With these facts, it may safely be said that Bristol's crowded thoroughfares, teeming with life and activity, its busy marts of commerce, extensive manufactures, handsome

public buildings and streets, civic, educational, commercial, scientific, religious and philanthropic institutions, its rapid increase in population both in the City and environs, its electric lighting, sanitary improvements, extension of docks, railways and tramways, the erection of new and the restoration of old churches, its magnificent suburbs and public recreation grounds, all point to the fact that the City is fully alive to the competition of modern times, and is determined to retain its ancient prestige as one of the most important cities in the Kingdom.

A few words with reference to the development of Bristol's industries and commerce since 1875 will demonstrate the fact that the prosperity of the City is not attributable to any one class of industry in particular, but that it relies upon so many, that where one has been withdrawn another has taken its place.

In the first instance, we will look at the growth of the trade in Leather and its kindred industries. In the year 1877 the local Tanneries were small, badly equipped, and their utmost capacity probably about 187,000 hides per annum. To-day the Bristol Tanneries are most of them equipped with the newest scientific and labour saving appliances, and the number of hides tanned annually probably now exceeds 250,000. It is also very satisfactory to note that the product of these tanneries for excellence of finish and, above all, durability, has a world-wide reputation. In the production of machine made Boots and Shoes a rapid advance has taken place, for whereas twenty-one years ago only about six factories of any size existed, to-day there are in Bristol and district about one hundred, with an out-put of about ten million pairs, representing an average turnover of about £1,500,000 sterling annually, one quarter of which is, in spite of the large increase in the use of machinery, distributed in weekly wages. To sum up the trade as a whole, it provides outlet for a capital of about £2,000,000 sterling, and gives employment to about 12,000 of our population, most of whom are heads of families, and thus takes a front rank in the list of industries of the City.

One of the most important Paper Industries of its kind in the United Kingdom exists in Bristol, employing upwards of 1100 hands, many of them of a highly skilled class. One of the special features of the paper business in Bristol is paper-bag making. Business bags were generally made by the tradesmen's assistants in their spare time, but by the greater variety and cheapness which they could offer, the industry is now concentrated in large factories. A local firm is the original patentee for the United Kingdom of the satchel shape bag machine. From a roll of paper about a mile in length, bags can be pasted, cut, folded and dried, and even printed in one operation at the rate of 120 to 200 per minute, according to size, without human intervention except in the adjustment from time to time of parts of the machine. The weekly out-put of paper bags from one firm is two and a quarter million. In Bristol is to be found large lithographic and printing plant, producing office stationery, labels, wrappers, price lists, etc., and for the production of the original designs and copper plates for these articles, large numbers of hands are employed. In the bookbinding trade Bristol is also an important centre. The increase of the business in the post office has led to an immense consumption of envelopes in the country, and Bristol has received its share in the increased business. Envelope machines are very ingenious and compact, and the deft manner in which they fold and gum the paper into the required shapes, turning out complete envelopes, is extremely interesting. About 500 tons of plain paper are now kept in stock by one local house alone. Colour Printing is very extensively carried on in Bristol, and recently several novel ideas have been introduced which will probably reduce to breaking-up value many machines which up to now have been the colour printer's sheet anchor. One firm engages 500 people in Lithographic Colour Printing and Paper-box making. About a million Chromo Almanacs are turned out every year. The amount of material and labour entailed in such an output can be better appreciated when it is remembered that each sheet almanac, which would measure on an average about 20 inches by

30 inches, would require to pass through the printing machine from ten to fifteen times, namely, once for every colour, before it is possible to make a complete picture. Added to this they are mounted on rollers, taped and rolled in a wrapper complete for sending through the post. Original oil paintings are purchased every year from the Royal Academy and leading London exhibitions, and reproduced with great fidelity by a staff of skilled artists for the production of these almanacs. Paper-Box making is also largely carried on, the newest and most economical machines are at work, and the growth of this department is proceeding apace. Three years ago boxes were all made by hand, now they are nearly all made by machinery; the result being not only a much greater speed in the output, but much greater accuracy and cleanliness in the finish.

The Publishing trade of Bristol is one that has developed very considerably during the past few years. It is extending itself now to nearly all parts of the world—America, India, Asia, Central Africa, the Cape, Australia, Canada, Egypt, etc. Not only is Bristol celebrated for its output of standard scientific works, notably those dealing with medical publications, but some of the most popular and successful novels of the day are being issued yearly from the Bristol press, and musical productions, especially sacred, are also taking a foremost position, and numerous works have of late been issued dealing with the historical events in connection with this city.

The manufacture of Cocoa and Chocolate forms one of Bristol's staple trades, and as an instance of the rapid development of this industry several new factories have been added since 1875, and other buildings are in progress to meet the demands of the ever increasing trade. The growth in the consumption of cocoa in the United Kingdom is an interesting fact, and proves the increasing appreciation by the public of this article as a beverage. Thus in 1875 duty was paid on 9,900,000 lbs., whilst in 1897 it amounted to 27,852,152, or nearly three times the quantity.

Engineering, Brass and Bell Foundries are old established

businesses in Bristol. About twenty-five years ago the art of church bell founding was revived. Since that period many hundreds of church bells for Great Britain and the Colonies have been cast.

A new business has sprung up in Bristol in connection with Brewers and Distillers' Engineering, and the output from Bristol is probably second to none in this country, and is capable of producing plant complete, from the boiler and steam engine to the smallest tap in use, and the exports are to Russia, India, Burmah, New Zealand and South Africa. On the occasion of the last visit of the British Association to Bristol, a firm in Castle Green were re-building their premises after a disastrous fire, when they found an old, dried well which contained numerous relics of the past history of Bristol Castle, consisting of stone cannon balls, broken articles of pottery, horns, etc., which were sent to the Bristol Museum.

Oil Cloth forms another important feature in Bristol's ndustries. Here the flax or hemp is prepared and spun, the cloth woven, and the boiling and refining of oil, so that everything that goes to compose finished floor cloth is entirely made in Bristol. This is one of Bristol's oldest industries, having been established in 1782, and is not only one of the largest in the West of England, but a considerable quantity of Bristol's manufacture is distributed throughout the country, in addition to a large export trade.

Brush Making is amongst Bristol's industries. It has been established for considerably over a century, and it is gratifying to know that the Bristol houses are upon the list for Government contracts, and that several of these have been secured during the past few years. Mop, mat and sieve manufactures also are carried on at several of the brush establishments.

There are several Cabinet Manufactories in the city of high repute, some of them being among the largest in England, wherein steam power is extensively used for turning, planing, moulding, veneering, morticing, carving, etc. Furniture suited to every grade of domicile, from the humble

cottage to the stately mansion, is made, and these establishments give employment to several thousands of hands. The large import of foreign timbers, particularly those kinds used in the manufacture of household appliances, has been, and still is one of the largest in England, and the best description of furniture is produced at a much less cost than in London and many other large manufacturing centres.

Carriage-building is also a busy trade in Bristol, and during the past few years the local coach-builders have begun to study more closely the requirements of carriage buyers, and the conditions under which the vehicles are used, the result being that they now manufacture landaus, broughams, etc., at a much lighter weight than in former years by disposing of useless material in the construction, but at the same time maintaining all the stability of the carriage. Up to the present, the introduction of the motor car has not affected the manufacture of horse-drawn vehicles, but there is every indication that the trade is fully prepared, although it is anticipated that some time may elapse before they will be suitable for private use. Carriages manufactured in Bristol will compare very favourably with those of any of the best London houses, in fact the best Bristol made carriages will hold their own in any market, either at home or abroad. After several years of great depression in the export trade, there seems a chance of its coming back to the old port, several orders having been executed for the Indies, as well as South Africa. As an instance of the development of this particular trade, it may be stated that one firm has during the last twenty-three years so increased their trade that to-day they pay away over 50 per cent. more in wages than in 1875.

One matter of scientific interest is the difficulty caused to this industry by the scarcity of English Ash, which is used for the foundation of carriage bodies, and up to the present time manufacturers have not been able to find any foreign or colonial timber to take its place.

Bristol is justly noted for the manufacture of medium and better class Woollen Clothing, particularly for men's wear, and the trade is developing in this direction, an important

feature being the special measure order department. Orders flow in from all parts of the world, and the City has won good reputation for quality.

The Corrugated Iron Works of Bristol are the largest in England; most of the iron used is manufactured at Wolverhampton, and brought from thence in barges. In the course of the year thousands of tons of iron are so sent. Working day and night is the rule of these works, and as much as 2,000 yards of netting a day can be turned out. Some of the best skilled workmen in the country are employed in Bristol, and more complete works it would be impossible to imagine.

The Manufacture of Corsets is a branch which from a small beginning has risen to the dignity of a staple trade. Only a few years ago half a dozen machines were introduced to the stitching of the heavy makes. These machines were clumsy, therefore did not find much favour with the trade. The invention of new machines has revolutionized the business, and it is stated that Bristol turns out more of this work annually, both for export and home trade, than any city in the kingdom.

Bristol holds an important position with regard to the Provision Trade. The increases during the past few years have been general, but more especially marked in respect to butter and cheese. In direct importation of Cheese from Canada, as a port, Bristol stands second only to London, Liverpool taking third place; but for Canadian butter Bristol takes not only first place as a port, but exceeds all other ports put together in quantity received.

With reference to the Grain Trade, no port in the United Kingdom is better suited to receive and distribute grain to all centres in the Midland and Western Counties of England than Bristol, as the returns for the past few years demonstrate. In 1875 the grand total of grain of all descriptions imported to the three docks of Bristol was 1,071,512 qrs., and in 1896, 3,327,042 qrs., and in the year 1897, 3,366,152 qrs.

The Timber Trade of Bristol has long complained of want of proper accommodation, and it is now satisfactory to know

that a thoroughly comprehensive scheme, jointly undertaken by the Corporation and the Great Western Railway Co., and already sanctioned by Parliament, will supply the old docks with railways extending into the timber yards. The Corporation has included in this section of their port development schemes a new deep water quay and public wharf for the timber trade. This expenditure will undoubtedly be beneficial to the trade.

The greatly increased tonnage of wood goods entering the port during the past few years is startling when compared with that of twenty or twenty-five years ago. Dock dues were paid on wood cargoes :—In 1875 on 127,800 loads ; in 1896 on 148,079 loads ; in 1897 on 188,729 loads.

A large proportion of this increased volume of timber imports has been brought about by the Dominion Line (African Steamship Co.). Messrs. Elder, Dempster & Co. have put a regular service of the finest cargo boats afloat on this station—Avonmouth to Quebec, Montreal, Boston and Portland. This enterprise deserves every encouragement by the citizens through the dock authorities, the adventure having already made considerable changes in the trade of the Bristol Channel.

The increase in this branch of Commerce, taken in conjunction with that of the Grain Trade, which has so enormously developed in recent years, clearly demonstrates that the splendid geographical position of the port as a distributing centre (for is it not the natural port and Western terminus of Great Central England?) is steadily regaining for it the importance that attached to it in its earlier history. It is an indisputable fact that the merchants at competing ports have recently found it to their advantage to draw their supplies of Canadian exports through the port of Bristol, and it is clear there is room for great development of trade when extended dock accommodation is provided.

The staple manufacturing industry of Tobacco shows a healthy and steady progress year by year, the rate of increase for the whole kingdom being $1\frac{1}{3}$ per cent., whilst that of Bristol is close upon $6\frac{1}{2}$ per cent., so that it may be fairly assumed that Bristol manufactures nearly one-eighth of the

whole manufacture of Great Britain and Ireland. Bristol has a world-wide reputation for its manufacture of the "weed." One of the largest establishments has been in existence considerably over a century and a half. Various firms have been amalgamated with others during the past few years, so that the number of factories is not so great as formerly.

Bristol was originally the centre of the Sugar Refining Industry, and although that has much declined of late years, it is pleasant to observe that the allied trade, namely, the manufacture of confectionery, bids fair to replace it. England now produces more sweets than any nation in the world: the amount of capital embarked in the trade is enormous, whilst the number of persons directly and indirectly employed, and the number of tons turned out annually, is almost incredible.

Since the visit of the British Association to Bristol, in 1875, several important alterations and additions have been made in the Railway Accommodation of Bristol, and possibly no town in the United Kingdom enjoys better main service to the Metropolis and *vice versa*, *viâ* the Great Western Railway, and it should also be noted that the Midland Railway Co. affords very liberal treatment.

One of the most important Engineering Works in the neighbourhood in recent years is that of the construction of the Severn Tunnel. Formerly passengers from Bristol to South Wales were conveyed across the Severn from New Passage to Portskewett in steamers which were run in connection with the railway. About the year 1870 the late Mr. Charles Richardson, C.E., conceived the idea of tunnelling under the Severn, and on the 13th June, 1872, Parliamentary sanction was obtained to a Bill authorising the carrying out of this work. The Great Western Railway Co. took charge of the scheme, though the undertaking was beset with many difficulties, owing to the flooding of the works, which delayed operations very considerably. Land springs were encountered, and it was found necessary to work permanent pumping machinery. It is very satisfactory to state that the great Severn bore was completed in 1885,

the first mineral train passing through it on September 1st, 1886, and the first passenger train on December 1st of the same year. The magnificence of the work may be judged when it is stated that the tunnel is 4 miles 624 yards in length, of which 2¼ miles are under the estuary of the Severn. At high water, spring tide, the rails are at one point 150 feet below the surface of the water. Up to the time it was completed, the estimated cost had been £1,650,000. The tunnel is admirably ventilated, and its construction has placed immense facilities in the way of passenger and mineral traffic between the West and South of England and the Principality. The time occupied in running through the tunnel is about seven minutes.

The City is well supplied with water by the Bristol Water Works Company, which has been in existence since 1846, the quantity of water delivered daily being at the rate of 22 gallons per head of the population. The total expenditure on the works exceeds a million and three-quarters and the revenue exceeds £113,000. Throughout the Company's district, the supply is given on what is known as the "constant service system," which means that the occupier of the poorest dwelling can draw from the house tap at any hour of the day or night, water delivered under pressure direct from the main. Recently a Committee of the Corporation was appointed to approach the Company with a view to the City acquiring the Company's undertaking.

Of the Bristol Gas Works the following statement relating to the year 1874 and the year 1897, will speak for itself:—

		1874.	1897.
Coal carbonized	Tons	82,683	189,043
Gas made	Cubic Feet	694,547,000	1,745,230,000
Price of Gas		4/-	2/4
Storage capacity	Cubic Feet	4,403,000	13,863,000
Meters in use		16,300	24,500
Mains laid	Miles	158	286¼
Public Lamps		3,791	7,573
Profit made	£	21,258	56,445

The Electric Lighting of the City is said to be one of the best in the United Kingdom, the principal thoroughfares

only have been equipped with the new illuminant, and the number of public lamps is 100, while upwards of 40,000 incandescent lamps have been connected for private consumers. The capital outlay is £100,000, and the Electrical Committee are making considerable extensions in order to meet the ever-increasing demands.

The growth and development of the Tramway System since the last visit of the British Association to Bristol has been remarkable. Strange to say, the first car tried on the line between the Drawbridge and Redland was on the 30th July, 1875, and since then the extensions have been enormous, in fact there is hardly a district now that does not enjoy a thorough and complete service of tramway.

The authorised capital of the Bristol Tramways Company was £591,666 ; £500,000 by shares and £91,666 by loans, of which £380,250 had been paid up ; £275,000 by shares, and £105,250 by loans, including debenture stock ; £368,785 had been expended on lines and works open for traffic, including land, buildings, etc. ; £33,388 on lines and works in course of construction ; £24,273 on horses—making a total of £426,446. The total length of tramway authorized was 21 miles 3 chains, of which 19 miles 65 chains was open for the public conveyance of passengers, and comprising 15 miles 42 chains double, and 4 miles 23 chains single line. The gross receipts from passengers during the year ending June 30 last, were £92,222 ; from parcels and mails £500 ; and from other sources £26,028—giving a total of £118,750. There was expended in working—£9,852 in the maintenance of ways and works ; £19,354 on animal power ; £4,821 in renewals, etc., of horses ; and £6,678 in repairs and renewals of cars. The traffic expenses were £41,879 ; direction and management £1,650 ; rent of offices, stables, and sheds, £5,255 ; legal and parliamentary proceedings, £306 ; and other working expenses, £2,711—making a total of £92,506. The net receipts were £26,244, the number of passengers conveyed, 18,592,936, and the number of miles run 1,746,180. The number of cars employed was 135, and of horses 837.

In 1895 was inaugurated the Electric Tramway system,

and as it is claimed that the Bristol electric lines have the distinction of being the first constructed under the modern conditions of improvement necessary to comply with the Board of Trade requirements, a passing reference may not be out of place here. The current is generated at a well fitted station, about mid distance from the ends of the line, and is carried by underground cables buried beneath the curb of the pavement. At points about half a mile apart, feeding conductors carry a part of the current to the overhead wire, and from this wire each car draws its supply. This is done by a long arm fixed to the top of the car. The arm has a little grooved wheel upon its extremity, and the wheel presses upwards against the wire and so taps the electrical supply. The current passes down to powerful motors in the base of the vehicle, and things are so arranged that the speed can be varied or the car be promptly brought to a stand-still. The electric current is not of sufficient tension to produce serious results should such an unlikely thing occur as anyone getting a shock owing to the breakage of a wire. The districts through which the lines go are purely working class, shoemaking and colliery work employing many, but a large number of the heads of households are employed in factories in the ancient city.

The manufacture of Locomotives in Bristol forms an important item of its industries. The pattern shops, plate shops, iron foundries, brass foundries, coppersmiths' shops, blacksmiths' shops, machine houses, are all well worthy of inspection, being kept in the best of order, well lighted and commodious. The machines appear almost countless, and are in beautiful working order, designed on the automatic principle. Amongst the numerous machines may be mentioned the radial drills which are so constructed to move to any part of the object to be drilled. A special class of machines are used for boring purposes, which may be seen in the act of boring. The all-important cylinders, wheel lathes for turning the wheels and boring the tyres, and special lathes for turning axles, which are all of the best steel, may also be seen. The next improved machines are those for planing. The hard steel and iron appear to be

as easily planed as wood is by the carpenter. The planing machinery, which works automatically almost without the aid of man, will fully repay a visit to the works. In the erecting shop may be seen locomotives in every stage of completion. Some of the finished locomotives are really beautiful specimens of this important branch of industry. They possess that important quality of compressed bulk, as well as the far more important quality of great power. Locomotives have been sent from Bristol to Sweden, Argentine Republic, Russia, Spain, Germany, Holland, South America, etc. Locomotives have also been supplied to the English Government for special purposes : to Railway Companies, and to celebrated firms for their own immediate use in this country.

As a steam producer petroleum is rapidly gaining in favour, and in influential circles of the trade the opinion is held that at no very distant period it will in this respect supersede to a great extent the use of coal, so that the importance of its future position in commerce is not at present easy to adequately estimate. Bristol is now a centre of constant activity in the importation and despatch of oil. The rate of progress has continued to be of a steady and satisfactory nature, and there are substantial indications of the thriving character of the trade in this community in the large number of railway tanks (especially constructed for the transit of oil) which are constantly to be seen on the railway sidings of the docks waiting to be filled and despatched, so that Bristol is now in a position to compete successfully with Northern ports, and has obtained a firm foothold in the Midland Counties as far as the Black Country.

A word or two respecting the Bristol Coalfield will not be out of place. Experts have asserted, and they have not yet been contradicted, that in the Bristol coalfield a superabundant supply of coal is close at hand, suitable for domestic use, gas or steam, and that the quality compares not unfavourably with fuel in other districts. These supplies of excellent coals are usually accessible by rail or water, but, unfortunately, for want of proper facilities this

mine of wealth has not been properly developed. Not only does Bristol possess large supplies of coal suitable for smelting purposes, but there are large deposits of ore within easy reach, and the necessary fluxing material is equally accessible at a cheap rate.

There are several large and old established Breweries in the City: they can turn out over 4,000 gallons of beer per day. There is a constant tendency towards the amalgamation of breweries, so that the number of brewing firms at the present time is not so great as in 1875. A large trade is done through branch stores and agents in London, and in the South and West of England and South Wales.

The manufacture of Mineral Waters is one of the most prosperous in the city, and as new beverages are continually being introduced to meet the increasing demands for temperance drinks, its growth has been very rapid. The highest awards for mineral waters at the leading exhibitions have been granted to Bristol houses for their productions.

The year 1762 saw the beginning of the manufacture of Optical Instruments in this city, and its development has been very marked, the leading firms having been awarded medals and diplomas at many of the leading exhibitions at home and abroad.

Organ Building has never developed so much as within the last twenty years in Bristol. The principal instruments are those of the Colston Hall, Cathedral, Victoria Rooms, St. Mary Redcliffe, Masonic Hall, St. Nicholas and the Grammar School, and Bristol hands are responsible for a considerable amount of work in all the counties of the Kingdom and abroad.

The first record of a Pottery in Bristol is in the reign of Edward I. Mediæval earthenware vessels of different periods of local manufacture occurred down to the reign of Elizabeth, at which time there was a pottery in full work. Towards the middle of the 18th Century the pottery in Bristol issued specimens of plastic art of surpassing beauty and skill, even rivalling the best productions in the East. The patent was sold to a firm in Staffordshire in 1777. The modern manufacture is ordinary white and printed ware,

which is exported in great quantities. Glazed Stoneware known as Bristol Ware, which superseded the old salt glaze, was invented and first made in Bristol in 1835. Subsequently several ingenious inventions have greatly simplified this.

Since 1853 all factories engaged in the manufacture of Bottles have merged into one house, and the output equals very nearly that of the whole glass manufacture of the 18th Century.

Bristol Stoneware has become celebrated, and is therefore imitated by other manufacturers, who style this ware wherever made, Bristol Stoneware. It is used for Jars and Bottles for spirits, acids, oils, wines, beers, ales, etc., and of late years there has been a great revival in its use for Ginger-beer and other aerated drinks, its strength and cool-keeping quality recommending it for all summer effervescing drinks. One firm has also, within the last few years, added a department hitherto untried in Bristol, and have been very successful in turning out battery jars, insulators, porous ware, etc., in stoneware and stoneware-porcelain. Large numbers of these articles are now in use all over the world, as well as in various parts of Great Britain, supplied by the above mentioned firm. Something over 200 hands are employed in this trade in Bristol. Another firm manufactures Earthenware in the great variety required for household use—dinner ware, tea ware, toilet ware, jugs, mugs, basins, etc. This also is an old established business, which has developed new life and energy under the present owners and managers, who have kept up with the times by introducing the best modern plant and machinery, and who are turning out large quantities of goods of high class, and sending them not only to all parts of Great Britain, but to all those colonies and ports where prohibitive duties are not levied, and to which Bristol, as a shipping port, gives them reasonable rates of freight.

Bristol boasts of the largest Rope-making establishment in the West of England. Wire rope for the rigging of ships and steamers, flat ropes for colliery purposes, long hemp and manilla rope, and twine for ordinary purposes are largely made. Several patents have been granted to the

Bristol firm for the packing of cylinders and steam chests of engines. Large quantities are supplied to all the leading railway companies of the Kingdom, in addition to which the firm has on several occasions during the past few years contracted for Government requirements.

Bristol has for many years past enjoyed a high reputation for the production of Waggons. It produces work for the home market and the colonies, consisting of waggons, carts, vans, etc., for ordinary roads and for agricultural purposes, and for railway carriages and waggons. The trade of the firm is cosmopolitan—Sweden, Russia, Austria, Italy, Portugal, Spain, West Indies, China, South Africa, New Zealand, Australia and Egypt, are amongst their market, but England, Ireland, Wales, and especially British India and South America, furnish the largest customers.

In the interval which has elapsed since the British Association visited Bristol in 1875, very important improvements have been made in the Postal and Telegraphic Services. There has been the establishment of the Parcel Post system and the Express Delivery and Railway Letter Service; a considerable reduction effected in postage, letters 4 ozs. in weight being now carried for 1d., and 11 lbs. being carried by Parcel Post for 1s.; and the abolition of the charge for redirection of letters, postcards, book-packets and newspapers.

A Telegraph Money Order system has been instituted, by means of which over half a million of money annually changes hands, and the benefit to people on journeys who are in need of getting money quickly, or in the ordinary course of business, is incalculable.

A system of withdrawing money from the Savings Bank by telegraph has likewise been set up. Also a stamp deposit scheme, whereby children are enabled to save their pence. The maximum sum allowed to be deposited in the Savings Bank has been raised to £200.

Letter-cards and reply postcards have been introduced, and an assimilation of the penny postage with the Inland Revenue stamp has taken place. The use of private postcards has been allowed.

In the Telegraph Service there has been a reduction from 1s. to 6d. in the minimum charge for an Inland telegram, and an abolition of the porterage charges for distances not exceeding three miles.

The whole of the Trunk Line Telephones have been taken over by the Post Office from the National Telephone Company, and the conversations held at Bristol number 137,000 in the year.

The Foreign and Colonial Services have likewise had their share in the improvements, such as the establishment of the Parcel Post, the institution of the International Express Letter Service, the adoption of a uniform rate of 2½d. for letters not exceeding ½ oz., the fixing of the weight of a single letter for places in the Postal Union at ½ oz. instead of ⅓ oz. and ¼ oz. as before, and the introduction of the "Acknowledgment of delivery" system.

Nowhere, probably, in the country have the changes had more marked effect than in this City, where the increase in business resulting therefrom, and from the gradual increase of the population, has been of an extraordinary character. Within the last quarter of a century it has been found necessary to increase the Post Offices from 82 to 166; the Telegraph Offices from 30 to 69; the Letter-boxes from 83 to 317; to build a large Depôt at the Temple Meads Railway Station for carrying on business incidental to the Parcel Post system; to double the size of the Central Office in Small Street; to increase the staff of all ranks from 313 to 940, exclusive of 500 Sub-Postmasters and Assistants. The letters, etc., posted annually have risen from 15,756,000 to 50,101,000. The parcels posted in a year number 750,250. The Money Order transactions have decreased, but the Postal Order, which has in a measure superseded the Money Order, is issued in Bristol at the rate of over half a million annually at the chief office and its three branch offices, to say nothing of the additional enormous number issued from the 166 sub-offices. The Savings Bank transactions have increased four-fold in the period under review. As regards telegrams, in the whole of the Bristol area the annual total amounts to about 1,000,000 delivered, 800,000 forwarded,

and 2,250,000 transmitted, or a total of over 4,000,000, whereas in 1875 the messages, all told, only numbered about a million and a half.

As time advances so the Telephone System becomes more and more a necessity to every professional and business man. This is evidenced by the rapid increases in the number of subscribers to the Bristol branch of the National Telephone Company. One of the most important recent changes in the working of the telephone is the successful adoption of the underground system. The progress of electrical science has rendered this practicable, and although the expense is great, the National Telephone Company are preparing to carry out this system in Bristol and in Bath.

LOCAL GOVERNMENT AND TAXATION.

By GEO. PEARSON,
Chairman of the Boundaries Extension Committee and the Electrical Committee.

IN an article upon the Local Government and Taxation of the city of Bristol it would be unwise to discuss Imperial questions or to go into the figures of the Imperial Revenue derived from the city or its port. I shall, therefore, avoid any reference to this, the larger subject, and confine my remarks strictly to Local Government and Local Taxation, and in the discussion of these local affairs it will, I think, at the present juncture, be both convenient and interesting if I take the periods in the history of Bristol which are marked by the three visits of the British Association to the city, viz. : the years 1836, 1875 and 1898.

Bristol, in the year 1835, consisted of 755 acres, having a population of 59,074 and a rateable value of £122,834, having remained of the same area from the date of the first of the small civic extensions, which took place in the year 1190, when King John, by a charter of that date, granted "The privileges therein contained to his Burgesses of Bristol dwelling within the walls and outside as far as the bounds of the Vill," which on the Somersetshire side he describes to be "as far as Brightnee Bridge in Bedminster and the Spring at Totterdown," which were the boundaries of the ancient vill of Redcliffe. "These comprehend within the same boundaries the two vills of Bristow and Redcliffe as though they had been one vill." The date at which the area on the Gloucestershire side of the city was joined to the city is immersed in obscurity. In the year 1232 Henry III. granted the Corporation a charter in which he states that :—"We have granted to you, in aid of enclosing the town (with walls) and for the security and preservation of the same and of the parts adjacent, certain Customs on wool, leather, &c." Similar but later charters speak in the same way, and there is no evidence that at

any time the suburban parishes were exempt from the taxation imposed on Bristol or ever desired exemption. By the charter of Edward III. the parishes were distinctly included, the boundaries being set out at full length.

Having remained for centuries without any important change in its area, Bristol was, in the year 1835 (just prior to the first visit of the British Association, in the year 1836) enlarged under the Municipal Corporations Act of 1835, and was rejoicing in the fact that its area had been increased from 755 acres to 4,461 acres, that its population had been increased from 59,074 to about 105,000, and that its rateable value had risen from £186,000 to £383,315. Its Corporation having just been re-formed, the city had been divided into ten wards, the number of Councillors being fixed at forty-eight and of Aldermen at sixteen, making a Council of sixty-four. The Council had been elected by the Burgesses and had the power of electing a Mayor and Sheriff; justice was being administered by Justices of the Peace appointed by the Lord Chancellor upon local recommendation, the Mayor being Chief Magistrate, and, as such, being entitled to be included in the commission of assize for gaol delivery. And it is useful here to note the change in the mode of the election of the Council. Before the Municipal Reform Act, the Council was practically self-elected. The Common Council were to consist of forty-two "of the better and more discreet citizens besides the Mayor for the time being; they were to assemble annually upon the 15th of September, and the majority, by their votes, were to choose and fill up any vacancy so as to make up the number to forty-two members." This mode of election doubtless had its advantages for the fortunate possessors of power for the time being, although we at the present moment may be unable fully to appreciate them; but it scarcely commends itself to modern ideas of representative government.

The Poor Law was administered by the Incorporation of the Poor within the area of the ancient city, and by the parochial authorities in the districts just then added to the ancient city.

This was the position of the city of Bristol on the first

visit of the British Association in the year 1836, and it is curious here to note the fact that the British Association is again visiting Bristol the year after the further extension of the city by the "Bristol Extension Act" of the year 1897, to which I shall have occasion hereafter to refer.

The accommodation afforded by the city for public assemblies on the occasion of that visit was not very good.

Above is given a small plan of the city engraved in the year 1836 for the guidance of the members of the British

Association visiting the city on that occasion. I am indebted to Mr. Latimer, the author of "Bristol in the 18th and 19th centuries," for the use of this plate.

This plan was printed on the back of the admission cards of the members of the Association, and an examination of it will enable the visitors of to-day to judge of the changes which have taken place in the city during the past sixty years.

The chapter room of the Cathedral does not appear to lend itself naturally to the discussion of "Statistics," although the Theatre would appear to lend itself naturally to "an evening meeting."

In the year 1836 the trade of the port was stationary if not declining under the management of the Dock Company who then owned the docks, which were subsequently acquired by the city in 1848, and the mismanagement of the Dock Company was assisted by the Corporation, who levied excessive dues on goods. The drainage was imperfect, the water supply non-existent, cleansing, watching and lighting but imperfectly performed ; and the whole forming a picture upon which Bristolians of to-day do not look back with pride, but it forms a point from which we may start in considering the changes and improvements which have since taken place.

1875.

Having considered the position of the city of Bristol at the date of the first visit of the British Association, I will now consider its position at the date of the second visit, in the year 1875. The city at that date consisted of 4,461 acres as settled by the enlargement in the year 1835. Its rateable value had grown to £779,572, and its population had grown to about 192,501. Its Council consisted of the same numbers of Councillors and Aldermen as was arranged at the time of the enlargement in 1835, and its magistrates consisted of about forty citizens appointed by the Lord Chancellor upon the representation of the two political parties. Its Poor Law administration was managed by three Poor Law Unions, known respectively as the Incorporation of the Poor, which had jurisdiction over the

eighteen ancient parishes which had formed the city of Bristol prior to the enlargement of the year 1835; the Clifton Union, consisting of the parishes of Clifton and Westbury-on-Trym, the latter parish being situated partly within and partly without the city; St. Philip and St. Jacob without; and the district of St. James and St. Paul, and a large area of rural district very scantily populated in addition to the city parishes before-mentioned which were situated in the city of Bristol; and the Bedminster Union, which consisted of the parish of Bedminster, partly situate within the city of Bristol and partly without, together with a large area of rural district very scantily populated. There were, therefore, within the city three Poor Law Unions: First—the Incorporation of the Poor—being strictly urban; and next, the two others, Clifton and Bedminster, being partly rural and partly urban; and in these Unions were to be found the usual conflicts which exist when an attempt is made to govern an urban and a rural district under the same body of Guardians. This was felt at that date to be an inconvenience, but it remained so until the year 1897.

The educational advantages of Bristol had not then progressed to the point they have since reached, although the Clifton College had been established some years and was doing an admirable work. The School Board had been recently established, and the following table will show the growth of Board Schools up to the year 1873, these being the latest figures published at that date.

	Average Number on Register.	Average Attendance.	Percentage.
Quarter ending March, 1871 ..	no return	13,385	—
Year ,, Dec., 1873 ..	23,366	16,528	70·7

The districts around Bristol, particularly that on the east, were growing, and the difficulty of Poor Law management was pressing itself on the attention of the Poor Law administrators, with a result that, within a year or two after the second visit of the British Association, the subject of Poor Law Reform was seriously proposed by the Incor-

poration of the Poor, and the consideration of Poor Law difficulties led to the discussion of other administrative difficulties and suggested reforms which culminated in a more important change involved in the passing of the "Bristol Extension Acts" of 1895 and 1897.

The growth of the population and rateable value of Bristol from the year 1836 will be seen from the table below :—

Year.	Population.	Rateable Value.
1836	105,000	†383,315
1841	122,296	382,772
1851	137,328	443,182
1861	154,093	508,988
1871	182,552	719,237
1875	*192,501	779,572

* Estimated.
† These figures are gross estimated rental.

The trade of the docks in 1875 was in a state of transition Docks were in course of construction at the mouth of the river at Avonmouth and at Portishead, the latter having received a contribution in aid of the undertaking of £100,000 from the Bristol Corporation subject to the condition of placing a given number of members of the Council as Directors on the Board of the Docks. The port, therefore, shortly after the year 1875, consisted of three docks : first, the ancient city docks which were the property of the Corporation ; the Avonmouth docks, which were the property of the Avonmouth Dock Company ; and the Portishead docks, which were the property of the Portishead Dock Company, subject to the civic regulation to which I have before referred. The Avonmouth dock was opened in the year 1877 and the Portishead dock was opened in the year 1879. The existence of these three docks in the hands of three separate bodies and under three systems of management resulted in a very severe competition, ending in a suicidal cutting of rates between the three undertakings, until it became so serious that it was felt that at all risks competition must be ended. After negotiations of some considerable length an agreement was ultimately arrived at in the year 1882 for the purchase

by the city of the docks at Avonmouth as well as those at Portishead, thus placing the whole dock accommodation of the port under the management of the civic Council.

The trade of the docks for the twenty-five years previous to the year 1875 will be seen from the table given below, which gives the net register tonnage of the vessels that entered the port.

Year.	Foreign.	Coast-wise.	Total.
1850	129,254	513,463	643,217
1855	147,968	530,783	678,751
1860	206,723	504,970	711,693
1865	242,693	531,252	773,945
1870	355,921	593,130	949,051
1875	416,755	592,832	1,009,587

About the year 1868 an important street improvement was undertaken, and the present street known as Victoria Street, leading from the Railway Terminus to Bristol Bridge, was made, and opened in the year 1870; and subsequently, in the year 1881, the connecting link now known as Baldwin Street, leading from Bristol Bridge to St. Augustine's Bridge, was opened.

The following table will show the rates levied in the city in the year 1875 :—

Name of District.	Poor Rate.	General District Rate.	Total.
The Incorporation of the Poor ...	3/0½	2/7	5/7½
Barton Regis Union	2/1	2/7	4/8
Bedminster	2/10	2/7	5/5

The city in the year 1875 presented a very different appearance to that of the year 1836. The drainage had been immensely improved; indeed, the sewers by that time may be said to have been completed and delivered into the tidal river. A water supply had been provided by the Bristol Water Works Company at a cost of £637,628, and its revenue at that time amounted to the sum of £54,098, and although the Company's system was not so perfect as it is at the present time, it was very satisfactory. Cleansing was done partly by contractors and partly by

the Sanitary Committee, and lighting had become universal and the city was lighted by 3,838 public lamps which consumed 69,715,664 cubic feet of gas, and which were

supplied with gas, lighted, cleansed and painted by the Bristol Gas Company at a cost of £15,197; and the watching was done by a well-managed Police Force. And

having regard to the advances then made in Municipal Government, Bristol, at that date, had no cause to feel ashamed of the position it occupied.

On opposite page is a small plan of the city in the year 1875, which was prepared for the use of the visitors at that date.

1897.

Having shortly pointed out the position of the city of Bristol at the dates of the two former visits of the British Association, I will now consider its position at the present date.

It has, under the Bristol Extension Act, 1897, been again enlarged, and has to-day an extent of about 11,468 acres, a rateable value of about £1,420,000, and an estimated population of about 318,000 ; its Council consists of sixty-three elected representatives and twenty-one Aldermen ; its magistrates consist of about fifty of all classes of citizens appointed by the Lord Chancellor upon the recommendation of the two political parties.

Its Poor Law administration is managed by one Board of Guardians consisting of sixty-three members, the same as the number of elected members of the Municipal Council. Its members are elected for the same number of years and for the same wards as the Municipal Council. It is hoped by means of the enlarged area to secure great economy in management and reforms in the treatment of all paupers, rendering possible that classification amongst paupers which has been the aim of Poor Law Reformers for many years, and thus paving the way for a more humane treatment of the deserving poor coupled with the stern repression of the undeserving ; but above all it will enable that still more serious problem of Poor Law administration to be seriously considered, viz., the best means of dealing with pauper children. From the old, however deserving, little can be hoped ; from the young everything may be hoped by a wisely humane Poor Law administration, and Poor Law administrators may live to see and to appreciate the results of their labours.

Its educational advantages are greater than in the year 1875. The University College has been started and the

buildings have made considerable progress, although far from complete at the present moment owing to the lack of the necessary funds. In the year 1873 the scheme was first mooted, and in the month of June, 1874, a meeting was held in furtherance of the scheme, and on the visit of the British Association to the city in the year 1875 a further meeting was held when the claims and advantages of the Institution were strongly urged by the then President of the Association, Sir John Hawkshaw, Sir William Thompson, and other visitors. And, in addition, the Merchant Venturers' Technical College and the High School for Girls at Cheltenham Road have been built, both being under the administration of the Merchant Venturers' Society). Educational advantages have been still further increased by the rebuilding on a new site in Tyndall's Park of the old Grammar School under the administration of the Bristol Charity Trustees; the Clifton and the Redland High Schools for Girls have also been established; and the School Board has spread its schools over the whole of the old city and the added area, thus securing uniformity of administration throughout the enlarged area which could never have been secured by the exercise of a varying discretion or by the divided action and the divided responsibility of the several School Boards formerly existing.

The following figures taken from the ninth triennial Report of the Bristol School Board will give some idea of the growth of the School Board work since the year 1875 :—

	Average No. on Registers.	Average Attendance.	Percentage.
Quarter to March, 1871 ...	no return	13,385	—
Year to December, 1873 ...	23,366	16,528	70·7
,, ,, 1876 ...	26,601	18,823	70·7
,, ,, 1879 ...	28,875	20,874	72·2
,, ,, 1882 ...	29,996	22,170	73·9
,, ,, 1885 ...	32,329	24,541	75·9
,, ,, 1888 ...	34,744	26,886	77·3
,, ,, 1891 ...	36,079	28,207	78·1
,, ,, 1894 ...	38,015	30,713	80·7
,, October, 1897 ...	39,226	32,944	84·0
In the month of Oct., 1897 ...	39,668	34,318	86·5

It will be seen from the foregoing figures that the attendance for the year to October, 1897, exceeded that of 1871 by 19,559. Whilst the population of the city has increased by 28·5 per cent. since 1871, the average attendance for the same period shows an increase of 146 per cent.

The number of Board School places added by the recent extension of the city to the accommodation provided by the Bristol School Board is as follows, viz. :—

	Boys.	Girls.	Mixed.	Infants	Totals.
St. George—					
Summer Hill ...	—	—	304	300	604
Two-Mile Hill ...	300	300	—	370	970
Crews Hole	—	—	149	90	239
Whitehall	346	296	—	353	1000
Higher Grade ..	200	200	100	—	500
Russell Town ..	260	258	—	360	878
Avon Vale	310	310	—	350	970
Easton	327	260	—	270	857
Greenbank	270	270	—	320	860
Totals ..	2013	1894	553	2418	6878
Stapleton—					
Eastville	425	360	—	426	1211
Chester Park ...	—	207	—	256	463
Totals ...	425	567	—	682	1674
Bedminster—					
Knowle	430	420	—	285	1135
Bedminster Down .	—	—	242	106	348
Totals ...	430	420	242	391	1483
Horfield—					
Bishop Road ...	294	278	—	232	804
Ashley Down ...	—	—	—	90	90
Totals ...	294	278	—	322	894
Grand totals	3162	3159	795	3813	10,929

Voluntary Schools in the absorbed districts provide places for 2,998 children. Of these, St. George supplies 1,024 places, Stapleton 1,114, and Horfield 860.

The Council has voted an expenditure of £200,000 to provide an electrical equipment suitable for the supply of

power for lighting, cooking, heating, and motive power or traction. It has 106 arc lamps at present in the streets, and it is anticipated that this number will be increased to something over 300 before the visit of the British Association. It has been, since the end of the second year, worked without loss to the city after providing for the working expenses, interest and sinking fund, and the profit during the year ended 25th March, 1898, amounted to the sum of £3,076.

The growth of this undertaking will be best seen from the table given below, for which I am indebted to the Secretary of the Electrical Committee, Mr. F. W. Prosser.

Year ending Dec. 31st.	Capital Expended during the Year.	Principal and Interest Repayments.		Lamps Installed during the Year.	Cost of Manufacture	Revenue.
		Principal.	Interest.			
	£	£	£		£	£
1893	49,983	1,000	1,280	7,465	2,184	1,594
1894	32,203	2,640	2,174	7,065	5,849	6,454
1895	15,608	3,600	3,042	9,516	5,825	9,844
1896	12,174	4,000	3,109	12,253	7,303	14,863
1897	3,191	480	504	2,537	1,806	5,496
(3 months to March, 1898*)	32,397	4,400	3,741	10,881	9,453	20,201
Totals	145,556	16,120	13,850	49,717		

The general increase of the city of Bristol will be best seen from the following table :—

	Area.	Population.	Rateable Value
1875	4,461	192,501	£779,572
1881	4,461	206,874	915,966
1891	4,461	221,578	1,037,431
1897	†4,661	232,242	1,153,311
1898	11,468	318,000	1,420,000

* This period was rendered necessary by the decision of the Committee to alter the date of making up their accounts from December 31st to March 25th to bring them in line with the general Civic accounts.

† These figures include the area at Avonmouth included in the city of Bristol under the Extension Act of 1895.

The figures for the year 1898 include the area, population and rateable value of the areas added by the Bristol Extension Act of the year 1897.

The following figures representing the tonnage of vessels will show the growth of the trade, foreign and coastwise, of the port of Bristol :—

Year.	Foreign.	Coastwise.	Total.
1875	416,755	592,832	1,009,587
1880	521,797	651,576	1,173,373
1885	590,976	655,260	1,246,236
1890	624,222	669,151	1,293,373
1895	794,520	760,825	1,555,345
1897	818,084	755,431	1,573,515

There is a very considerable grain trade done in the port of Bristol and its position in that trade will be best gathered from the return below :—

Statement shewing Grain Trade of Port of Bristol as compared with other Ports.

	1892. Tons.	1893. Tons.	1894. Tons.	1895. Tons.	1896. Tons.
London	(1,335,047	1,436,642	1,617,428	1,734,463	1,718,787
Percentage of total into U.K.	—	—	20·3	21·4	20·4
Liverpool	1,622,789	1,520,238	1,487,906	1,767,366	1,841,114
do.	—	—	18·8	21·7	21·9
Hull	806,721	811,500	1,017,231	1,042,893	1,052,327
do.	—	—	12·7	12·9	12 5
Bristol	513,417	607,583	742,966	648,767	679,918
do.	—	—	9·3	8·03	8·1
Glasgow	365,224	339,333	325,643	284,770	325,756
do.	—	—	4·09	3·5	4.1
Plymouth	—	—	133,104	121,946	157,254
do.	—	—	1·6	1·5	1·8
Southampton	—	—	102,376	90,851	109,620
do.	—	—	1·2	1·1	1 3
Newcastle	—	—	109,546	102,461	114,984
do.	—	—	1·3	1·2	1·3
Cardiff	153,848	132,031	176,379	183,450	189,745
do.	—	—	2·2	2·2	2·2

The cattle trade, although liable to fluctuation, is also developing at a somewhat rapid rate, as is also the flour, mineral, oils, cotton and other seeds, American provisions and green fruit, as will be seen from the following figures, shewing the imports for the last twenty years :—

IMPORTS OF CATTLE, FLOUR, OILS, PROVISIONS, &c., FROM FOREIGN PARTS.

YEAR.	FLOUR.	MINERAL OILS.	COTTON & OTHER SEEDS.	BACON & HAMS.	CHEESE.	GREEN FRUIT.	CATTLE.	SHEEP.
	Tons.	Tons.	Tons.	Tons.	Tons.	Boxes.		
1878	14,231	13,922	6,395	3,306	5,331	116,086	2,938	4,851
1879	15,420	10,343	11,476	6,298	6,361	35,479	3,391	13,648
1880	10,097	15,178	14,574	7,836	6,378	59,079	9,709	15,323
1881	12,812	18,645	9,659	9,131	6,860	89,476	9,798	28,324
1882	16,448	21,190	14,080	5,914	4,611	87,811	4,743	6,284
1883	23,678	14,250	19,140	3,984	2,977	68,807	2,302	4,833
1884	28,727	14,296	7,776	2,777	3,609	84,950	7,108	11,762
1885	38,812	18,910	16,871	1,902	6,456	66,392	4,373	1,715
1886	26,032	22,473	18,324	4,086	8,330	71,485	9,629	4,026
1887	38,998	20,922	14,266	5,031	7,981	71,035	7,016	11,995
1888	56,505	23,237	25,430	3,732	10,177	90,981	7,334	4,238
1889	37,834	20,318	24,927	3,799	8,487	94,210	12,650	5,596
1890	39,933	22,193	21,451	7,443	10,482	89,760	17,298	5,960
1891	36,505	36,494	21,576	7,486	12,623	76,498	17,104	3,079
1892	51,689	29,418	25,418	6,228	12,617	85,265	12,257	5,773
1893	62,930	43,247	24,194	9,535	18,380	102,288	15,410	1,053
1894	59,938	44,974	31,074	6,099	15,977	120,828	8,034	27
1895	48,636	54,332	27,625	8,964	19,146	124,044	17,376	9,519
1896	39,879	57,549	37,408	7,533	17,693	116,976	10,954	40,466
1897	74,064	54,422	43,445	11,013	19,280	132,730	19,129	6,864

The Municipal indebtedness amounts to the sum of £3,544,791, the particulars of which are given below :—

Docks	£2,254,665
Municipal, other than Sanitary & School Board	344,344
Sanitary	747,251
School Board	198,531
	£3,544,791

against which may be set the assets as valued for the purpose of the recent Extension proceedings as follows :—

UNREMUNERATIVE.

Lunatic Asylum	£1,326,047
Free Libraries	
Museum and Library	
Police Stations	
Police Court	
Council House	
Assize Courts	
Destructor	
Parks and Open Spaces	
Hospitals	
Fire Extinguishing Appliances ...	
Baths and Wash-houses (4)	
Workshops, Plant, Stables, Horses, &c.	
Mansion House	
Schools	

REMUNERATIVE.	
Electric Light	200,000
Docks and Shipping Dues ...	2,254,665
Estates and Markets (net revenue £25,000)	750,000
Property not producing revenue, such as Street Improvement, Salvages, Green's Dock Estate, &c., &c.	50,000
Cemetery	25,000
	£3,279,665

TOTALS.	
Unremunerative	£1,326,047
Remunerative	3,279,665
	£4,605,712

To the assets before mentioned should be added the large Municipal Charities administered by the Municipal Charity Trustees, an account of which will be found in another part of this volume.

The annual repayments of principal of various loans now outstanding amounted, prior to the extension of the city, to about £53,000 per annum. The same repayments for the enlarged area amount to about the sum of £60,000.

The rates levied upon the ratepayers within the city of Bristol during the past five years will be seen from the following tables :—

	1893.	1894.	1895.	1896.	1897.
Bristol Average ...	6/0¼	6/9¾	6/4	6/2¼	6/4¾

But as Bristol was situated within three Poor Law Unions, and as the Poor Rate in each Union varied, the rates levied upon various citizens residing within different Poor Law areas within the city were not the same, and the contributions borne by the various citizens were unequal. The actual rates levied in the various parts of Bristol will be seen from the table given below, and the increase since the year 1875 is to be accounted for mainly by the increase in the School Board and Sanitary expenditure.

	1893.	1894.	1895.	1896.	1897.
Barton Regis Union ..	5/11	6/8	6/2½	6/0½	6/3
Bristol Union	6/4	7/1	6/6½	6/4½	6/7½
Bedminster Union ..	6/1	7/2	6/9	6/3½	6/6

The following table will show the proportion of the expenditure of the General District Rate for one half-year by the various Committees deriving their funds from that rate :—

Committee.	Estimated Expenditure for Half Year ending 29th Sept., 1897.			Equivalent to a Rate in the £.
	£	s.	d.	Pence.
Sanitary Committee—				
Finance	15,932	14	1	3·61
Highways, Sewers and Cleansing ...	38,505	0	0	8·73
Parks and General Purposes	13,698	0	0	3·10
Public Health	4,945	0	0	1·12
New Streets Committee ...	14,793	7	1	3·35
Baths Committee	900	0	0	0·20
Electrical Committee ...	1,450	0	0	0·33
Museum Committee ...	1,075	0	0	0·25

The city of Bristol presents to-day a very different aspect to that of 1875. The drainage remains as before, but a resolution of the Council has been passed suggesting its removal from the river and the Sanitary Committee has the subject under consideration. The water supply has been improved by the Bristol Water Works Company by the provision of large additional storage accommodation and the acquisition of additional springs, and their capital to-day stands at the sum of £1,721,882, and their revenue has risen to £113,988 per year. The cleansing, ashing and watering is now done entirely by the Sanitary Committee. They have in their employ about 900 men, their weekly wage sheets average about £1,800, and they have a stud of about 200 horses engaged in the hauling department. They have extensive workshops in which repairs to carts, harness, &c. are done, and they have an extensive paving manufactory in which the *débris* from the destructor is used in the production of good paving. Part of the city sweepings are now destroyed in a destructor erected at a cost of £14,000, and about one half of the refuse is dealt with by these means; the Sanitary Committee are considering the site for the erection of a second destructor, by the means of which it is hoped to deal with the whole

refuse and do away altogether with the present unsightly tips. The gas lighting is still done by the Gas Company who at present supply about 7,400 lamps consuming about 145,208,048 cubic feet at a cost of £3 per lamp per year for the supply of gas, also lighting, extinguishing, painting and repairs, and, in addition, the Electrical Committee supply the current to about 106 arc lamps of 2,000 nominal candle power at a cost of 4½d. per unit of current consumed and the net costs of carbons and labour in trimming and repairs, which number, it is hoped, will be increased to 300 by the time of the visit of the Association at a cost of £23 per lamp per annum, to include current, trimming, painting and repairs. The watching is still done by a very efficient body of police to the number of 500.

The Bristol Extension Act, in addition to extending the area of the city of Bristol, operated as a Consolidation Act, consolidating the various authorities which took part in the administration of the affairs of the area now included within the city of Bristol, and the extent of the consolidation effected by, or in consequence of, the Act will be best seen from the table given below :—

Names of the Authorities in Existence at the Passing of the Extension Act.	Number of such Authorities.
County Councils	3
Boards of Guardians	4
Highway Boards	3
School Boards	4
Urban District Councils	5
Rural District Councils	3
Parish Councils	6
Overseers	15
Burial Boards	2
Total Authorities	45

The Act reduced the number of authorities to three, the Bristol School Board administering the Education Acts, the Guardians of the Parish of Bristol administering the Poor Law Acts, and the Bristol Town Council performing the whole of the duties of the government of the city not carried out by the Board of Guardians or the School Board.

The foregoing figures are exclusive of the administration

of Justice, which was formerly undertaken by four separate Courts of Summary Jurisdiction, three Courts of Quarter Sessions, and three Courts of Assize. Justice is now administered by one Court of Summary Jurisdiction, one Court of Quarter Sessions and one of Assize.

British Association
BRISTOL 1898
SCALE 20 INCH TO A MILE
SECTIONS
A Museum
B. University College
C. Hannah More Hall
D. Free Arts Association
E. Blind Asylum
F. Merchant Venturers' College
G. Park Place School
H. Victoria Chapel School
K. International Conference on Terrestrial Magnetism
P. Prentice's Address
R. Reception Room
S. 1st Course, Old Fire Office
X. Smithfield Exhibition of Fine Arts and Objects of Local Interest
Y. Lunch at Room, Grammar School
Z. Biological Exhibition
Old Fire Office
Victoria Rooms
Victoria Chapel
Grammar School
Museum
Reception Room
Lunch at Room
Biological Exhibition
Smithfield Exhibition
Prentice's Address
CANON'S MARSH
QUEEN'S ROAD
PARK ROW
PARK STREET
BERKELEY SQUARE
ZOOLOGICAL GARDENS
CLIFTON COLLEGE
CLIFTON WOOD
CLIFTON DOWN
HOTWELLS
HIGH STREET
COLLEGE GREEN
CHRISTMAS STEPS
WHITE LADIES ROAD
ST. MICHAEL'S HILL
CHARLES STREET
MILLENNIUM SQUARE
CHRISTCHURCH
ST. MARY REDCLIFF
ST. MARY REDCLIFF CHURCH
ST. MARY REDCLIFF HILL

I have endeavoured to sketch the position of Bristol at the dates of the two former visits of the British Association and also at the present time with a view of enabling visitors to note the growth of and the changes in the city at each successive visit in the hope that the information to be found in these pages may be of use to our visitors in September next and not without interest to the citizens of Bristol.

CHARITIES.

By FREDERICK W. NEWTON.

THERE is probably no city in the Kingdom which, in proportion to its population, is more abundant in charities than is the City of Bristol. The names of Colston, Whitson, Thorne, Carr, White, Reynolds, and her other pious founders, are ever held in grateful remembrance as having bequeathed their wealth for the relief and succour of poor citizens, and the education and advancement of their children. The City is no less indebted to the wealthy burgesses of the present day, who, emulating the benevolence of their predecessors, exhibit a like spirit of large-hearted liberality in the support of the manifold voluntary charities with which the City abounds

The following figures, based upon Returns to the House of Commons, 1873 and 1893, furnish an approximately correct estimate of the yearly income from Endowments, *viz.* :—

	£	s.	d.
Education	21,822	17	6
Apprenticing and Advancement of Children	808	10	10
Church Purposes	5,769	9	3
Purposes of Nonconformist Bodies ..	1,477	11	4
Almshouses and Pensions	13,018	2	11
Medical Relief and Nursing ..	6,020	19	0
Gifts to the Poor in Money and Kind	3,788	7	2
General Uses of the Poor	4,998	6	6
Other Public Uses	422	8	4
TOTAL	£58,126	12	10

Chief among the various agencies by which these charities are distributed is that of the Trustees of the Bristol Municipal Charities, who dispense yearly, for charitable —including educational—purposes, an income of about £25,000, arising from landed, house, and funded property. These (municipal) charities were formerly administered by the Corporation, but by the Act of 5th and 6th William IV.,

Cap : 76, commonly known as the "Municipal Corporations Act," their management was vested in twenty-one Trustees, appointed in the first instance by the Lord Chancellor, and more recently by the Board of Charity Commissioners for England and Wales.

Within the limits assigned to this section of the work, it would be quite impossible to give a complete and exhaustive list of the charitable bequests and institutions of Bristol, but the principal of these may be indicated.

Hospitals, Infirmaries, Etc.

Bristol Royal Infirmary, Maudlin Street. Instituted 1735. Number of Beds, 270.

Bristol General Hospital, Guinea Street. Established 1832. Number of Beds, 200.

Bristol Royal Hospital for Sick Children and Women, St. Michael's Hill. Founded 1865. Number of Beds, 104.

Bristol Dispensary, Castle Green.

Bristol Eye Hospital, Lower Maudlin Street. Founded 1810. Number of Beds, 28.

Bristol Eye Dispensary, Orchard Street, St. Augustine's. Established 1812.

Bristol Medical Mission Dispensary, 7, Redcross Street. Founded 1872.

Bristol Homœopathic Hospital and Dispensary, Brunswick Square and Triangle.

Clifton Dispensary, Dowry Square, Hotwells, and Richmond Hill, Clifton. Founded 1812.

Clifton Medical Charitable Fund. Established 1868, for the relief of the Poor of Clifton. Consulting Room, 4, Gloucester Place.

Convalescent Home for Children, Weston-Super-Mare (in conjunction with the Children's Hospital). Number of Beds, 28.

Orthopædic Hospital and Home for Crippled Children, Grove House, Redland. Patients, 35.

Read Dispensary for Women and Children, St. George's Road. The medical attendants are women.

Redland Dispensary, 2, Grove Buildings, Redland.

Voluntary Lock Hospital, for Women only, 87, Ashley Road.

Jubilee Convalescent Home, Durdham Down. Founded 1898, as a permanent memorial of the Queen. Intended primarily for the use of patients of the medical charities of the city, but with some provision for other convalescents also. Number of Beds, 80. N.B.—£83,000 has been subscribed, but an effort is being made to raise the total amount to £100,000.

ALMSHOUSES, ETC.

All Saints' Almshouse, Rupert Street. For 8 Women, selected and appointed by the Vestry from the parish poor, who receive 5s. 3d. per week and other gifts.

Bengough's Almshouse, Horfield Road. For Married Couples and Single Women, inhabitants of Bristol; half the inmates being Church people and the other half Nonconformists. Weekly pay: married couples 10s., single women, 7s.

Blanchard's Almshouse, Grosvenor Road. For 3 poor old maids "whose labour is done," being members of the congregation at Old King Street Baptist Chapel. Weekly pay 5s. 6d.

Broadmead Chapel Almshouses, Broadmead. For 4 aged female members of the congregation, who each receive 2s. 6d. per week.

Burton's Almshouse, Long Row, Thomas Street (founded by Symon Burton, in the year 1292). For 16 poor and infirm old women of the parish of St. Thomas, who each receive 6s. weekly from the parish funds and a small donation from the Municipal Charities.

Colston's Almshouse, St. Michael's Hill. For 12 men and 16 women, being communicants of the Church of England, and otherwise qualified by birth or long residence in Bristol, or as Freemen of the City; or as being the widows, sons or daughters of persons possessing one or other of those qualifications. Weekly pay 7s. besides other benefactions.

Foster's Almshouse, Colston Street. For 4 men and 24 women, inhabitants of Bristol. Weekly pay 7s.

Fry's House of Mercy, Colston Parade. For 8 women of fifty years of age and upwards, well bred and of good character, members of the Church of England, not in receipt of poor law relief. Weekly pay 3s.

Lady Haberfield's Almshouse, Hotwells. For 24 men and women of fifty-five years of age and upwards : one half of whom to be parishioners of the old parish of Clifton, and the other half to be parishioners of the old parish of St. Mary Redcliff; "poor, impotent folk of good character," members of the Church of England, and who have never been in receipt of poor law relief. Weekly pay 7s.

Hill's Almshouse, Berkeley Place. For 12 women, fifty years of age and upwards, residents in the parish of Clifton, or in that of St. Augustine-the-less, and members of the Established Church. Weekly pay 7s.

Merchant's Almshouse, King Street. (Formerly called St. Clement's almshouse). For poor, decayed mariners and seamen, and their widows, who receive 6s. per week and other benefactions. There are 11 men and 17 women in residence.

Merchant Tailors' Almshouse, Merchant Street. For 9 women of fifty years of age and upwards ; or, without the age restriction, in the case of persons unable by reason of illness to maintain themselves. Widows of Tailors preferred. Weekly pay 6s.

Redcliff Poor House, Commercial Road, Redcliff. For 14 women and 1 man, being parishioners of St. Mary Redcliff, who receive from 2s. to 2s. 3d. per week each.

Ridley's Almshouse, Milk Street. For 5 batchelors and 5 maidens, "old, poor, decayed," who receive 4s. 6d. per week each.

St. James' Poor House, Whitson Street. For 12 women, who receive 4s. per week each.

St. John Baptist's Almshouse, St. John's Steep. For 8 women. Weekly pay 3s. 5d., with other benefactions.

St. Nicholas' Almshouse, King Street. For 12 women and a matron. Allowance from Endowment and Church funds.

Alderman Stevens's Almshouse, Old Market Street.

For 28 women, 12 of whom are paid 8s. per week, and the remainder 5s. per week.

Temple Hospital (Rev. Dr. White's), Temple Street. For 32 women, upwards of fifty years of age, to be chosen only out of Temple, St. Werburgh's and All Saints' parishes. Weekly pay 6s.

Trinity Hospital, Old Market Street. For 8 men and 52 women, inhabitants of Bristol. Weekly pay 7s.

Unitarian Almshouse, Stokes Croft. For 11 women and 1 man. The inmates are paid 12s. 11d. per month each.

Orphan and other Asylums and Homes.

Müller's Orphan Houses, Ashley Down. This noble charity was founded by the Rev. George Müller, in the year 1836. The buildings consist of five houses, similar in plan, plain, substantially-built, and generally well adapted for their humane purpose. They provide accommodation for 2,050 children of both sexes, born in wedlock, having lost both parents and being legally destitute; and children so qualified are admitted without favour or partiality in the order of application. The buildings were erected at a cost of £115,000. The annual cost of clothing, maintenance, and education of each child is about £13, exclusive of the salaries of officials, who number some 120. The girls are trained for domestic service, and the boys are apprenticed to trades. No debt has ever been contracted in the history of this great undertaking, which is entirely dependent on voluntary and *unsolicited* contributions. Visitors are conducted over the houses on the following days of the week, between the hours of 2.30 and 3.30, *viz.*, Tuesday, No. 2; Wednesday, No. 1; Thursday, No. 3; Friday, No. 4; Saturday, No. 5.

Arno's Vale Penitentiary, for about 30 inmates. Conducted by the Sisters of the Roman Catholic Convent of the Good Shepherd.

Asylum for hopeful, discharged, Female Prisoners, Park Row. Established 1853.

Asylum for Poor Orphan Girls, Hooks Mills, Ashley Hill. (Church of England.) Instituted 1795. Provides a home

for about 50 destitute girls who have lost both parents. They are trained for domestic service.

Blind Asylum, Queen's Road. Instituted 1793. For the instruction of the blind of both sexes, from any part of the Kingdom, in some art or manufacture whereby they may be enabled to maintain themselves. The chief industries are mat, rug and basket making and chair seating.

Bristol Female Penitentiary, King's Parade, Redland.

Children's Home, 3, Aberdeen Road, Clifton. Established 1881. For reception and training of neglected or orphan girls under thirteen years of age, and boys under eight years of age, for emigration to Canada.

Deaf and Dumb Institution, Queen's Avenue, Queen's Road. For the education—mental, technical, and manual of deaf and dumb persons of both sexes.

Female Refuge Society, Marlborough Hill. For the reclamation of fallen women. The inmates are employed in needle and laundry work.

Girls' Industrial Home, Dowry Parade, Hotwells. For destitute girls, who are trained for domestic service.

Guardian House, Upper Maudlin Street. For young girls of good character and in destitute circumstances, who are trained for domestic service.

Home for the Blind, St. Michael's Hill.

Home for Boys, Silver Street, Broadmead. For respectable but friendless working boys, who are provided with lodgings at 1s. per week.

Home for Ladies of Limited Means, Clifton Hill.

Home for Lady Annuitants, Bellevue, Lower Clifton Hill.

Home for Working Girls in Business, Bishop Street, St. Paul's (founded in memory of the late Mary Carpenter). Provides a comfortable home for girls employed in factories, etc., who pay 1s. to 1s. 6d. per week each. The balance of expenses is defrayed from Endowment and voluntary contributions.

Home of Rest for Women, Upper Belgrave Road, Durdham Down. For working women and girls over fourteen, who need rest and change, and who are admitted by subscribers' notes.

Longman Memorial Home, Fairlawn, Clifton Wood. For 12 young girls, who are trained for domestic service. The object is to reclaim the fallen and to protect others who may be surrounded by evil influences.

Preventive Home, Royal Fort. For the removal of young girls from the influence of evil associations, and their education and training for domestic service. Connected with this Home is a Laundry-Home at Fishponds for feeble-minded girls. The institution is supported entirely by voluntary contributions.

Royal Victoria Home (Police Court and Prison Gate Mission), Manor and Victoria Roads, Horfield. For inebriate women, homeless discharged prisoners, and other females who, not being prostitutes, may be sent to the Home by the magistrates, or admitted by the Committee. The younger women are trained for domestic service, and all are instructed in some industry. The Home is supported solely by voluntary effort.

Temporary Home for fallen women (Maternity Cases), Southwell Street, Kingsdown.

Annuities, Pensions, and Annual Grants.

Municipal Almshouse Charities (Foster's and Bengough's Almshouses, and Trinity Hospital). After providing for the maintenance of the Almshouses, the surplus income is applied in Out-Door Pensions of 8s. per week to single persons, and 9s. per week to married men, with like qualifications to those of the almsfolk.

Bonville's Charity. (*a*) Annual Grants to Housekeepers over fifty years of age, residing in the ancient City of Bristol. There are 5 recipients of £21 a year; 15 of £10 10s.; and 50 of £5 5s. (*b*) 24 Annual Grants of £13 to Lodgers, qualified as above.

Bristol Benevolent Institution. For the exclusive benefit of persons who have carried on business or profession in Bristol for not less than seven years, and of the widows and unmarried daughters of such persons, not being under the age of fifty-five years. The amount of Grant in each case is at the discretion of the Committee, but does not

exceed £21 per annum for females and £24 per annum for males. There are about 70 annuitants. The Institution is principally dependent on voluntary contributions.

Margaret Edgar's Charity. One Annuity of £35 to a single woman with qualifications similar to those requisite in the case of applicants for Hannah Ludlow's Charity.

Gist's Charity. Annuities of £18 4s. to 3 men, and £15 12s. to 3 women. Candidates must be natives of the ancient City of Bristol, over fifty years of age; and preference is given to persons who have been in better circumstances than the ordinary poor.

Hill's Almshouse Out-Pensions. 46 Women Pensioners, qualified as for the Almshouse, are paid 7s. per week each.

Edmund Lane's Charity. 2 Annual Grants of £15 to poor tradesmen or tradeswomen resident in Bristol.

Hannah Ludlow's Charity. 18 Annuities of £30 to widows or single women, natives of Bristol, above the age of 50 years, and in reduced circumstances.

Merchants' Almshouse Out-Pensions. 4 Pensioners (2 men and 2 women), qualified as for the Almshouse, receive 7s. per week each.

Merchant Tailors' Almshouse Out-Pensions. 28 Pensioners (15 men and 13 women) qualified as in the case of the Almshouse, receive 6s. per week each.

Merlott's Charity for the Blind. 47 Annuities of £10 for poor persons above fifty years of age, living in any part of Great Britain, having been "stone-blind" for not less than 3 years.

National Benevolent Institution. (Bristol District.) Founded 1810, for the relief of distressed persons in the middle ranks of life, of whatever country or creed, of 60 years of age and upwards, or labouring under physical disability to maintain themselves. There are about 26 pensioners, who receive £15 per annum each. The Institution is supported by annual subscriptions, donations and bequests.

The Edward Phillips Trust. (*a*) Annual Gifts of £30 to gentlewomen of the age of 55 and upwards, being natives of, or resident for 10 years in the Municipal Borough of

Bristol. (*b*) 10 Annuities of £20 to widows resident within the Municipal Borough of Bristol, whilst in needy circumstances, and during widowhood: each such widow having at the time of election a child or children under fifteen years of age. (*c*) Annual Gifts of £7 15s. to poor Householders of fifty years of age and upwards resident within the Municipal Borough of Bristol. These gifts are confined to the recipients of Bonville's Gift of £5 5s. to Housekeepers. (*d*) Annual Gifts of £2 10s. to Housekeepers qualified as above. Only the recipients of Bonville's Gift of 10 guineas to Housekeepers can obtain these gifts.

Sion Hospital Pensions (Bristol Foundation). £36 a year to 4 men and 4 women, being inhabitants of Bristol, over fifty years of age, and too infirm to work.

Temple Hospital Out-Pensions. 14 Pensioners (1 man and 13 women), qualified as for the Almshouse, receive 6s. per week each.

**Anchor Society* Annuities of £13 to aged persons.
**Dolphin Society* Annuities of £13 to aged persons.
**Grateful Society* Annuities of £13 to aged persons.

In addition to the foregoing, might fittingly be enumerated the *Formidable Training Ship* with her Tender "Polly," stationed at Portishead—The *Red Lodge Reformatory* founded by Lady Byron (widow of the poet) and for many years conducted by the late revered Mary Carpenter, together with other Industrial, Reformatory, and Ragged Schools—The many gifts in cash and kind to lying-in women and other necessitous poor—The work of such societies as the *Gloucestershire Society* for the relief of indigent women in child-birth and the apprenticing of boys; *The Reynolds Commemoration Society* for aiding the necessitous poor; *The Friend-in-need Society*, which

*These three Societies meet annually on 13th November to celebrate the anniversary of Edward Colston, and the amount then contributed (about £3000 a year) is applied in annuities, apprentice fees, and money gifts to lying-in women and others.

seeks out and aids the distressed in their own homes; the *Bristol and Provident Clothing Society*, which helps impoverished persons to clothe their families; the *Blanket Lending Societies*, and a vast number of other agencies, which are far too numerous to be even named here. And, besides these, are the almost innumerable parochial charities which afford efficient help in the effort to stem the tide of want and destitution in this great city.

METEOROLOGY:

(Rainfall and Temperature.)

By C. LLOYD MORGAN and BERTRAM ROGERS.

The following tables, compiled from publications of the late Dr. Burder, and from data published or supplied by Mr. D. Rintoul, Mr. E. J. Lowe and others, afford a considerable body of reliable statistics relating to local rainfall and temperature.

Those who are unwilling to grapple with so formidable a mass of figures as Table I. supplies, may turn to Table II., which shows at a glance the variations in the annual rainfall of Clifton for the last forty-five years. The fluctuations in amount are well seen in the zig-zag course of the line which joins the annual records (given in figures in the last column of Table I.), and their range is clearly indicated, extending from $22\frac{3}{4}$ inches as a *minimum* in 1864, to $48\frac{1}{4}$ inches as a *maximum* in 1882. Running through the diagrammatic record of these fluctuations, however, there is evidence of a more generalized mean curve, gradually rising towards about 1880, and sinking, but not so low, towards 1890, and then rising again. And a reference to Table V. will show that if the forty-five years be divided into 10-year periods, the mean rainfall is least in the first, rises during the second, reaches its highest point during the third, dips during the fourth, and rises again in the mean rainfall of the outstanding five years from 1893 to 1897.

The curve of monthly rainfall is given in a similarly diagrammatic way in Table III. It will be noticed that the smoothness of the curve is broken by two angulations—a smaller one for March, in the dry period from February to June, and a more marked one for September, in the wet period from July to January.

Passing next to Table VI. it will be seen that the rainfall varies in space as well as in time. On the average of the last fifteen years, for example, that of Bath was, in round numbers 29 inches; that of Bristol, 30 inches; of Clifton, 33

inches; and of Shire-Newton Hall, on the further side of the Severn, 40 inches.

Directing our attention now to the Temperature returns, we have not so long a series of reliable data. Those for the last fifteen years are given at some length in Tables VIII. and X. The bottom line of Table VIII. shows how slight, in any year, is the variation of mean temperature above or below the average of 49·35° for the whole period; the greatest excess being 2·11°, and the greatest deficit 1·38°. But a consideration of the monthly records shows that they are subject to a much wider range of variation, the January temperature of 1890, for example, being more than 10° higher than that of 1895, while that of December was more than 10° lower. Again, the difference between the warmest and the coldest month was in 1888, about 20°, but in 1890 nearly 30°.

When the monthly averages for the fifteen years are considered, their distribution is found to be fairly uniform. This is shown diagrammatically in Table IX., which gives at a glance the gradual rise of mean monthly temperature from January to July, and its more rapid descent from August to December.

The extreme range of shade temperature for Clifton during the fifteen years is seen by Table X. to be 75·6°, from 87·8° in the summer of 1885 to 12·2° in the winter of 1895.

In conclusion, it may be noted that a comparison of the tables for yearly rainfall and temperature fails to indicate any definite connection between wet years and cold years or conversely. The years 1892 and 1893, for example, were both relatively dry; but the former was the coldest and the latter the warmest during the last fifteen years. Again, 1891 and 1894 were both wet years; but the former was well below, and the latter decidedly above, the average.

Nor does a comparison of the mean monthly rainfall with the mean monthly temperature indicate any definite connection. The curves in Tables III. and IX. show little in common. The rainfall, in fact, is chiefly determined by the *relative* temperatures of sea and land, the prevalent set of the winds, and partly by electrical conditions.

Table I

The Monthly Rainfall in Clifton for 45 Years, from 1853 to 1897.

The first 39 years (1853–1891), are from the records of the late Dr. Burder, taken at 7, South Parade, Clifton, at an elevation of 192 feet above ordnance datum. The last six years (1892–7), are from the records of Clifton College, at a height of 230 feet above mean sea level, supplied by Mr. D. Rintoul.

Year.	Jan.	Feb.	March	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
1853	2·994	0·773	0·544	3·125	2·335	4·385	4·787	4·486	3·324	3·934	2·946	0·607	34·200
1854	3·206	1·013	0·670	0·022	3·398	3·669	2·534	1·338	1·089	3·340	1·988	1·996	23·663
1855	0·311	1·462	2·166	0·429	2·188	3·628	3·490	2·789	0·849	6·060	0·541	0·992	24·905
1856	3·455	1·868	1·193	3·666	3·142	1·669	1·737	4·694	5·240	2·730	0·720	2·465	32·579
1857	2·707	1·552	1·883	2·857	2·074	2·108	2·501	3·968	2·215	3·275	1·668	1·071	27·879
1858	1·201	1·165	1·073	2·904	2·468	2·006	1·911	2·062	3·270	2·673	1·503	2·884	25·120
1859	1·995	1·654	4·747	2·955	2·390	1·929	3·938	3·950	4·185	2·224	3·045	3·861	36·873
1860	4·943	0·994	2·915	1·688	3·539	7·104	1·869	5·682	2·434	3·027	2·828	3·755	40·798
1861	1·933	2·751	2·935	0·305	1·385	3·339	4·534	2·568	3·860	2·283	4·860	1·459	31·312
1862	3·203	0·413	4·496	3·135	3·358	2·728	2·536	1·447	2·389	5·717	1·469	1·982	32·873
1863	4·087	0·809	0·832	1·894	2·252	4·645	0·509	3·879	3·584	5·203	2·903	1·666	32·263
1864	1·564	1·881	2·623	1·395	0·865	2·123	1·002	1·121	3·356	1·895	2·945	1·976	22·746
1865	3·764	2·879	1·157	0·729	1·986	1·578	4·233	8·508	0·022	4·969	3·253	3·426	36·504
1866	4·217	4·801	2·090	1·684	1·115	3·622	2·663	3·254	7·404	1·919	2·394	4·945	40·108
1867	4·867	2·712	4·865	3·410	2·520	2·069	2·728	2·046	1·338	3·643	2·200	1·570	33·968
1868	5·898	1·970	1·790	2·306	1·764	0·639	0·882	5·761	2·995	2·755	1·673	5·672	34·105
1869	5·368	3·882	1·203	1·126	6·304	1·026	0·957	1·396	5·775	2·439	2·399	4·296	36·171

1870	2·477	1·400	1·576	0·566	1·545	0·619	1·472	2·000	1·770	5·333	2·741	1·930	23·429
1871	2·118	1·560	1·495	3·759	1·255	1·447	5·114	1·865	5·239	2·430	0·626	2·238	29·097
1872	6·416	4·187	2 202	2·750	2·651	3·418	3·724	2·178	2·207	4·124	4·326	4·183	42·366
1873	4·438	1·422	3·631	0·595	2·041	1·172	4·140	3·784	2·914	3·887	2·734	0·711	32·069
1874	3·927	2·399	2·144	1·988	0·663	1·061	1·558	4·637	7·071	3·825	2·358	3·617	35·248
1875	5·144	2·248	1·455	2·091	2·867	3·525	5·091	1·785	4·599	6·977	6·085	1·280	44·047
1876	2·623	4·871	4·049	3·071	0·227	0·929	1·638	4·715	5·353	3·395	4·582	6·962	42·415
1877	4·599	2·376	2·451	2·977	2·213	1·182	3·136	5·186	2·873	3·103	5·932	2·202	38·230
1878	1·579	1·836	2·313	2·952	5·857	3·166	2·033	4·221	2·923	5·958	3·138	2·043	38·019
1879	4·307	3·921	1·102	2·863	3·218	5·145	3·669	7·319	3·906	1·276	0·586	1·345	38·657
1880	0·658	4·519	2·639	2·397	1·244	2·447	4·831	0·409	3·661	5·997	3·095	5·476	37·373
1881	1·714	3·838	1·935	0·612	1·516	3·550	2·469	5·635	2·100	2·262	4·323	4·152	34·106
1882	2·718	2·438	2 294	4·068	1·928	3·372	6·180	5·177	2·696	7·135	5·819	4·455	48·280
1883	3·911	3·995	0 952	0·859	1·576	3·107	3·672	2·384	4·476	3·424	4·950	1·486	34·792
1884	4·820	1·849	2·689	1·117	2.501	3·867	3·665	2·744	1·998	1·167	1·686	5·289	33·392
1885	2·735	3·345	1·221	2·181	3·256	1·733	0·974	2·323	4·846	4·525	6·425	1·235	34·793
1886	4·923	0·819	2·814	2·317	4·675	1·017	3·689	2·537	2·683	4·942	4·076	5·182	39·704
1887	2·271	0·695	2·382	1·956	2·337	1·001	1·125	2·938	3·422	2·481	2·772	2·412	25·793
1888	1·110	1·737	3·541	1·775	1·405	3·998	6·225	2·547	1·284	1·063	6·530	3·294	34·509
1889	0·844	1·538	4·383	4·766	2·687	0·512	4·428	3·328	2·268	2·264	1·221	2·253	30·492
1890	3·898	0·579	1·109	1·140	1·869	3·021	3·411	2·932	1·431	1·673	2·551	1·300	24·914
1891	3·830	0·003	2·797	1·228	3·776	2·319	3·186	7·439	2·328	8·494	2·494	4·627	42·521
1892	1·432	2·040	0·680	1·027	1·183	2·253	2·854	3·926	3·599	2·908	2·419	1·455	25·776
1893	2·105	4·543	0·635	0·067	1·290	1·201	4·265	2·388	1·802	5·735	2·390	2·818	29·299
1894	2·994	4·135	2·725	2·811	1·944	2·446	5·030	3·526	3·283	3·681	5·905	3·033	41·523
1895	4·127	0·130	2·472	2·715	0·970	0·885	3·634	3·636	1·205	4·260	5·580	2·939	32·553
1896	0·628	0·530	3·635	0·627	0·375	1·320	0·916	2·142	7·487	5·476	0·684	3·938	27·758
1897	1·895	3·465	4·085	3·871	1·690	3·215	1·918	6·894	3·877	1·211	2·273	4·610	39·004
Av. of 45 yrs.	3·090	2·198	2·280	2·062	2·284	2·458	3·061	3·545	3·258	3·686	3·059	2·913	33·693

Table II

The accompanying diagrams show (Table II.) The Mean Yearly Rainfall at Clifton for the forty-five years, based upon the foregoing records ; and (Table III.) The Mean Monthly Rainfall.

Rainfall at Clifton in each Year from 1853 to 1897.

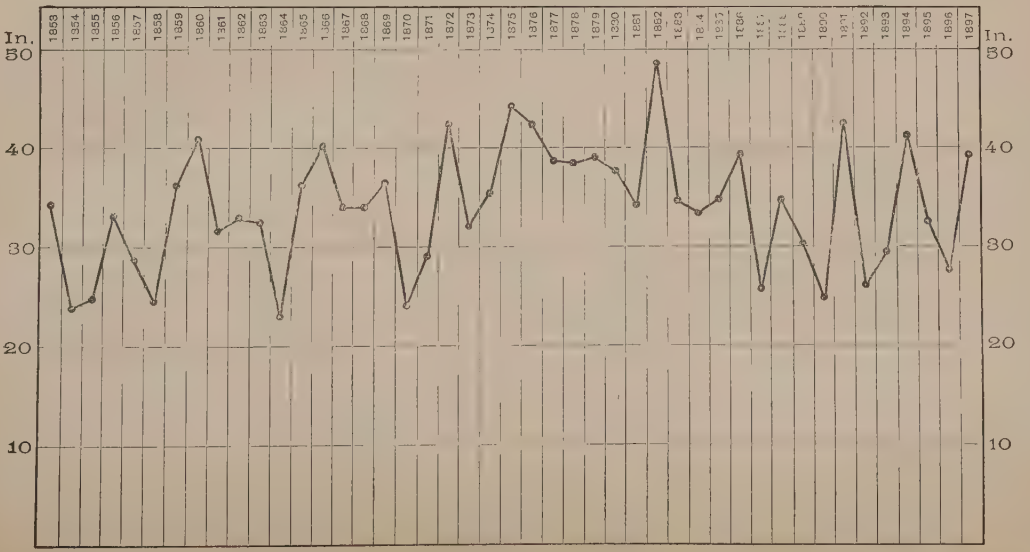
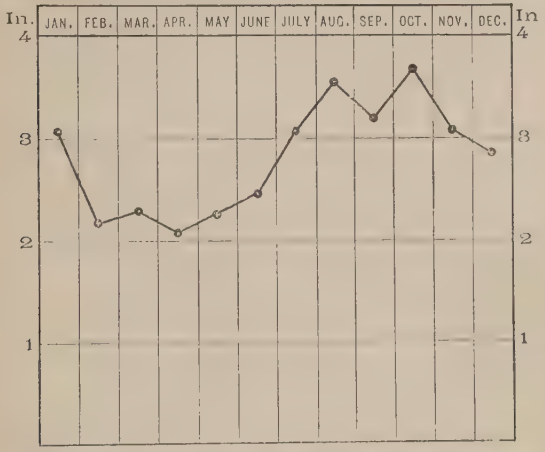


Table III.

Mean Monthly Rainfall for 45 Years.



The dryest month of the year is April with a mean of 2·062; the wettest month, October with a mean of 3·686. The five months from February to June are relatively dry; the seven months from July to January are relatively wet.

Table IV.

Extremes of Monthly Rainfall from 1853 to 1897.

It will be seen that the widest variations are in February and in September; the least variations in March and in October.

	Least Fall.		Greatest Fall.	
	Depth.	Date.	Depth.	Date.
	Inches.		Inches.	
January ...	0·311	1855	6·416	1872
February ...	0·003	1891	4·871	1876
March ...	0·544	1853	4·865	1867
April ...	0·022	1854	4·068	1882
May ...	0·227	1876	6·304	1869
June ...	0·512	1889	7·104	1860
July ...	0·509	1863	6·225	1888
August	0·409	1880	8·508	1865
September	0·022	1865	7·487	1896
October ...	1·063	1888	8·494	1891
November ...	0·541	1855	6·530	1888
December ...	0·607	1853	6·962	1876

TABLE V.

The means of the four complete 10-year periods and that of the outstanding five years from 1893 to 1897.

	Mean of First Ten Years	Mean of Second Ten Years	Mean of Third Ten Years	Mean of Fourth Ten Years.	Mean of Five Years, 1893 to 1897
	Inches.	Inches.	Inches.	Inches.	Inches.
January ..	2·505	4·078	3·171	2·977	2 349
February	1·360	2·608	2·987	1·660	2·500
March ...	2·262	1·983	2·401	2.256	2·710
April ..	2·109	1·962	2·361	1·836	1·998
May .	2·628	2·221	2·237	2·526	1·213
June ..	3·197	2·119	2·555	2·282	1·825
July ..	2·984	2·328	3·564	3·322	3·152
August ...	3·298	3·201	4·287	3·309	3·717
September	2·885	3·369	3·810	2·831	3·530
October ..	3·526	3·471	4·382	3·294	4·072
November	2·157.	2·546	3·865	3·532	3·566
December	2·109	3·190	3·224	2·853	3·467
Year ..	31·020	33·076	38·844	32·668	35·587

TABLE VI.

The mean annual rainfall for the last fifteen years (1883 to 1897) at a few localities in the neighbourhood of Bristol.

Locality.	Height Above Sea-Level.	Recorder.	Mean Annual Rainfall.
Clifton College ..	230	D. Rintoul	32·8
101, Pembroke Road, Clifton ...	215	R. F. Sturge	33·47
Bristol Docks	45	J. M. McCurrich	30·09
Over Court	147	R. Cann Lippincott	32·4
Barrow Gurney	320	Bristol Water Wks. Co.	35·86
Litton	360	,, ,,	37·37
Hathcroft Rectory ..	411	Rev. R. P. Davies	26·33
Bath	75	Rev. H. Winwood	29·08
Piercefield Park ..	270	H. Clay	34·4
Shire-Newton Hall .	531	E. J. Lowe	39·987
Upfield, Stroud ..	226	Miss Rose Stanton	28 25
Cirencester	421	Miss E. Brown	29·46
Whitcombe Reservoir	297	R. Reid	27·66

Table VII.

Gives an example of excessive rainfall in twenty-four hours which occurred on August 30, 1897, as collected by E. J. Lowe, Esq., F.R.S.

Locality.	Inches.
Backwell	3·75
Long Ashton	3·59
Bristol Docks	3·12
Wraxall	3·03
Clifton College	2·40
Abbots Leigh	2·13
Barrow Reservoir	2·10
Over Court	1·67
Almondsbury	1·55
Nailsea	1·50
Shire-Newton Hall	1·27
Chepstow	1·25
Chew Magna	1·20
Cirencester	1·03
Harptree	·90
Gloucester	·79

Excessive snowfall occurred in and near Bristol on March 18th and 19th, 1867, with a depth of twelve inches; on January 17th and 18th, 1881, with a depth of ten to twelve inches; on March 15th, 1887, with a depth of fifteen to sixteen inches; and on February 13th, 1888, with a depth of twelve inches. (E. J. Lowe.)

Table VIII.

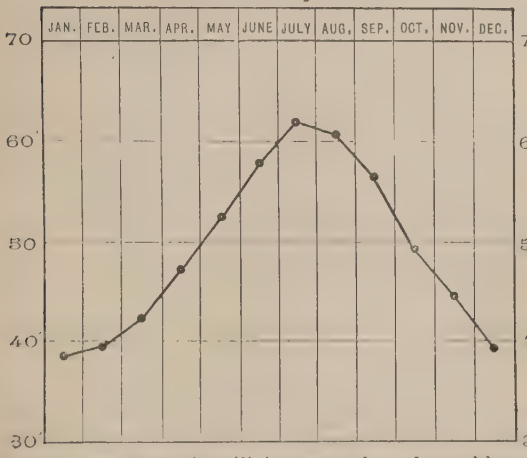
Mean Temperatures of the Months at Clifton College for the last Fifteen Years.

The figures (from data supplied by Mr. D. Rintoul) give the means between maxima and minima taken at 8.30 a.m. The thermometers are kept in a Stevenson cage, and in all the readings the requirements of the Royal Meteorological Society are strictly complied with.

Month.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	Mean of 15 Years.
January	42·3	44·2	38·7	35·5	41·5	38·5	37·2	43·8	35·8	37·1	35·98	38·69	32·98	41·16	35·68	38·61
February	43·3	42·3	44·0	35·8	41·0	36·1	39·0	38·7	42·0	38·9	42·04	42·10	28·17	40·12	44·61	39·88
March	37·0	44·9	41·7	40·1	39·9	38·6	41·5	44·7	39·6	37·6	47·16	45·37	42·55	45·64	45·17	42·10
April	47·5	45·1	46·7	46·4	42·2	44·1	46·1	47·3	44·9	47·5	53·69	51·22	48·44	50·42	46·59	47·21
May	49·9	53·3	47·0	52·2	45·5	52·5	55·8	54·9	50·0	54·3	57·50	50·17	56·48	57·00	51·87	52·56
June	57·2	59·8	58·4	58·8	62·4	57·9	61·3	57·5	60·1	58·1	62·37	57·72	61·21	63·47	60·76	59·80
July	57·2	60·7	62·6	62·7	63·9	58·4	61·1	59·1	59·9	59·6	62·88	61·41	61·50	63·36	64·17	61·23
August	60·6	64·5	57·5	59·1	60·4	59·3	59·2	59·4	58·3	61·1	64·78	58·85	61·39	59·91	62·30	60·44
Sept'mb'r	55·3	59·4	54·5	58·2	53·7	57·3	56·9	59·7	58·7	55·6	57·01	54·46	62·03	50·94	55·52	56·62
October	49·6	48·9	45·6	52·9	46·1	48·8	48·8	51·3	50·3	45·4	50·69	58·89	46·43	45·19	51·93	49·39
Nov'mber	42·8	41·6	43·3	47·1	41·2	47·2	46·7	44·9	42·8	43·8	41·61	46·92	47·20	39·84	46·23	44·21
Dec'mber	41·4	43·1	38·8	38·6	39·9	42·7	39·4	30·1	41·3	36·7	41·88	41·81	40·52	40·61	42·37	39·95
The Year	48·7	50·7	48·1	49·0	48·4	48·45	49·41	49·28	48·64	47·97	51·46	50·73	49·07	49·80	50·60	49·35

TABLE IX.

AVERAGE MONTHLY MEAN TEMPERATURE FOR LAST 15 YEARS.



From these tables it will be seen that the coldest month is January, with a mean of 38·61; and the warmest July, with a mean of 61·23.

TABLE X. gives somewhat more detailed information.

YEAR.	MAXIMUM IN SHADE.		MINIMUM IN SHADE.		MEAN IN SHADE.	MINIMUM ON GROUND.
	HIGHEST RECORDED	MEAN.	LOWEST RECORDED	MEAN.		
1883	82·5	54·54	20·9	42·88	48·71	19·3
1884	87·5	57·44	22·6	44·07	50·66	23·7
1885	87·8	53·98	22·1	42·53	48·09	20·1
1886	83·5	54·90	21·7	43·17	49·03	15·3
1887	82·8	56·0	20·4	40·9	48·4	11·7
1888	79·1	54·19	22·3	42·74	48·45	18·0
1889	80·5	55·22	22·2	43·60	49·41	18·2
1890	76·0	55·16	19·1	43·40	49·28	17·2
1891	79·1	54·59	15·2	42·70	48·64	15·2
1892	79·5	53·71	17·3	42·21	47·96	14·9
1893	86·5	58·02	17·7	44·91	51·46	12·9
1894	87·2	55·97	14·1	44·52	50·73	11·8
1895	82·2	55·32	12·2	42 82	49·07	11·5
1896	84·2	56·22	26·5	44·36	49·80	24·5
1897	84·9	56·01	22·6	45·12	50·60	22·2

The minimum record in the Stevenson cage is 12·2 (1895) (on the ground, 11·5); the maximum record is 87·8 (1885). An unusually great difference between the maximum and minimum within twenty-four hours occurred on April 10, 1892, amounting to 32°.

PUBLIC HEALTH.

By D. S. DAVIES, M.D. London, D.P.H. Cantab., Medical Officer of Health.

BRISTOL is now a city of 316,000 inhabitants, living upon an area of 11,000 acres, and it thus ranks by population as the seventh largest town in England.

Before the Extension Act of 1897 came into operation, the city contained a population of 230,000, living upon an area of 4,000 acres, with a density of population as great as forty-nine to the acre; this central nucleus had remained unchanged for sixty years, and, having no room in late years for normal expansion, it became surrounded by legitimate outgrowths occupied by an overflow population, whose inclusion at length rightly restored the balance of control in the city, and the position of the city in the State.

Bristol, by reason of its antiquity, has had considerable experience of disaster by plague and pestilence. Of the attacks recorded the most severe appears to have been the Plague of 1349, during which probably one half the population perished, and following which grass is said to have grown inches high in the streets. At that time, as up to the end of the seventeenth century, the streets were too narrow for vehicular traffic, the less important streets were little better than deep dark lanes, and the projecting upper stories cut off light and air. During succeeding centuries the sweating sickness and plague often alternated as causes of most serious mortality. Even in the present century Bristol has shared in the devastating results of cholera, which in 1849 claimed 2,000 victims in this city. But the time was now ripe for experience to produce amendment, and the growth of modern preventive medicine may reasonably be connected with the successive impulses given to the study of disease causation and prevention by the English Cholera Epidemics of 1832, 1849 and 1854. The commencement of civil registration in 1837, though it was late in adoption in comparison with Sweden and some other countries, gave

at length an opportunity of accurately gauging the value and results of sanitary measures, not only in the case of occasional fatal epidemics, but also in the case of the commoner preventable diseases, of which enteric and typhus fevers alone are responsible, during the fifty-four years from 1832 to 1885, for eight times the mortality of cholera, or for a total number of deaths in England amounting to 1,500,000.

Water Supply.—When plague was devastating Bristol in the 14th century it was noted as a redeeming feature in the sanitary condition of the town that it had an abundant supply of water conveyed through conduits, for which it was largely indebted to its Monasteries.

At the present day the city is still indebted to private enterprise for its excellent supply of water.

In 1846, on the authority of the Health of Towns Commissioners, the city of Bristol, containing 130,000 inhabitants, had a most inadequate water supply, probably more so than any town of equal size in England, and in this year the Bristol Water Works Company was formed. By this time the houses had spread over the sources of some of the local supplies, which were thus rendered no longer safe, and the Company very properly went for their supplies to deep springs rising in the Triassic conglomerates and carboniferous limestone of the Mendips at various points from five to fifteen miles distant from the city. In 1867 a further source of supply was added from deep wells in the New Red sandstone at Chelvey, and in 1888 the Company obtained powers to take the Richford Spring, near Blagdon, and the Langford Spring, at Langford; and in 1889 to make a reservoir by impounding the river Yeo which also rises from deep springs. The older supplies are collected in three storage reservoirs at Barrow with a total capacity of 850,000,000 gals.; the Yeo reservoir will contain 1,700,000,000 gals. The water is supplied to the city at constant service, and the average daily supply per head is about twenty-two gallons; the water from the Barrow store reservoirs is now filtered before delivery. The sources of the supplies are situated far from and above reach of human contamination, and not only has no prevalence of disease ever been traced

to the water, but there is little doubt that some part at least of the great improvement in the public health which has characterized the past forty years would have been impossible to secure had not such a wholesome and reliable supply been made available.

ANALYSIS OF WATER SUPPLIED BY THE BRISTOL WATER WORKS COMPANY.

By F. WALLIS STODDART, F.I.C., F.C.S., City Analyst.
(Results stated in grains per imperial gallon).

	Gauge House, Barrow (Unfilt'r'd)	Cold Bath Spring.	Deep Well, Chelvey.
Colour in 2-ft. tube	Greenish Brown	Pale Green	Pale Green
Sediment	Sand-algæ	none	none
Saline Ammonia	·001	·0007	·0002
Albuminoid Ammonia	·004	·0020	·0010
Nitrogen as Nitrates	·09	·12	·17
Nitrites	none	none	none
Chlorine as Chlorides	·97	·91	1·13
Oxygen absorbed in 4 hours	·039	·003	·014
Total Dissolved Solids	19·70	23·50	22·54
Lime	9·06	11·05	9·88
Magnesia	·65	·92	1·18
Sulphuric Anhydride (SO_3)	·86	·98	·83
Lead, Copper, Zinc	none	none	none
Total Hardness	16·0	20·5	20·0
Permanent Hardness	3·5	4·5	5·0

Sewerage.—Older Bristol is a completely sewered city; cesspools are not countenanced, and no dry systems of disposal are in use. Some of the recently included areas do not conform to this definition, but this will gradually be rectified. The aggregate length of the main sewers is about 150 miles, and the cost of construction, commenced in 1851, amounted to about £161,000. The sewers take all storm water, which reaches them by way of trapped street gullies; they are without any external openings or special ventilating outlets, and the manholes are all closed down. The sewers are so designed and constructed with regard to capacity, fall and position that they may be ultimately converged to one point, from which an outfall sewer may be continued to a

suitable point in the Bristol Channel. The sewage is at present discharged without treatment into the tidal Avon, double tidal valves being fixed at the outlets. The question of the disposal of the sewage of Greater Bristol is now under the consideration of the Council.

Hospitals for Isolation Purposes.—The three leper hospitals which existed in Bristol in the fourteenth century may point to an extreme local prevalence as well as testify to the general endemicity of this disease. With the extinction of leprosy, the existence of permanent institutions for communicable disease probably ceased, and until quite recently the huge error of hastily providing hospitals upon occasion for dealing with the victims of an epidemic, rather than of retaining hospitals ready equipped for the prevention of epidemics, has prevailed. So long, too, as the infectious sick were a divided care between the Poor Law Guardians and the Sanitary Authority, difficulties were bound to exist ; and the wise policy of accepting the whole of this duty as an integral part of Public Health work must have good results.

The City Isolation Hospitals occupy two sites. One at Nover's Hill, Bedminster, for smallpox, thirteen acres in extent, to provide fifty-one beds in five blocks, including one isolation block, and a discharge block. An administration building and full laundry accommodation are also provided. The second Hospital, for the isolation of scarlet fever, diphtheria, or other fevers, is situated at Ham Green, three miles by road from the Suspension Bridge, and accessible from the river Avon. The present area devoted to hospital buildings is thirty acres, but there is room, if needed, for considerable extension. The site is to provide 185 beds in eleven blocks, including two isolation blocks, and discharge blocks. An administration building and full laundry accommodation are provided. All the permanent wards are of modern design and construction, and allow 2,000 cubic feet air space for each inmate.

Public Health Organization.—The growth of Public Health work in recent years is to some extent indicated by the increase in the Medical Officer of Health's staff. When the Association visited Bristol in 1875, a Chief

Inspector and five Assistant Inspectors, who devoted half their time to the supervision of street watering, ashing and cleansing (work now undertaken by a separate cleansing staff under the City Engineer), represented the whole of the staff of the Health Department under the Medical Officer of Health. At the present time the Urban Inspectors number nineteen and the Port Inspectors two, and they devote the whole of their time to the work of the department.

Inspecting Staff.—The work of the Inspecting Staff has increased considerably in recent years, especially since the adoption of the Notification Act of 1889, which, while giving information invaluable for the control of disease, has at the same time doubled or trebled the amount of routine inspection and supervision. There are now, for purposes of the enlarged city, eleven District Inspectors, one Inspector of Common Lodging Houses and Bakehouses, one Inspector of Dairies, Cowsheds and Milkshops, two Inspectors of Meat and Fish, and two Inspectors of Workshops. At the head of the Inspection Department are a Chief Inspector and a Superintendent Inspector.

Health Committee. The work of the Medical Officer of Health's Department has lately been entrusted to a separate Committee of sixteen members, meeting on alternate Tuesdays—Chairman, Alderman Cope-Proctor.

Ambulance Service and Disinfection.—Two specially constructed pair-horse brougham ambulances with rubber tyres are provided for the removal of patients for isolation. Disinfection of bedding and clothing is carried out in Washington Lyon's steam disinfector, which has now stood the test of ten years' work. For disinfection of room interiors, fumigation and the perchloride of mercury spray are found most generally effectual.

Laboratory Work.—Since 1895 examination of throat cultures for the bacillus of diphtheria has been made in the Medical Officer of Health's laboratory; during the past year the application of the blood serum test (Widal) for enteric (typhoid) fever has been also undertaken. Both these bacteriological methods have proved of very great service in assisting and confirming the diagnosis in obscure cases; the

diphtheria examination has enabled more than one outbreak of diphtheria to be checked by demonstrating the bacilli in unsuspected patients; while the Widal reaction quite recently played a most important part in actually *establishing* the diagnosis, during the autumn of 1897, of a milk-borne enteric fever outbreak, which had proved most puzzling, and was generally mistaken for influenza. The information thus afforded much facilitated the ready suppression of the outbreak. During the year 390 diphtheria examinations and 257 Widal examinations were conducted in the laboratory. The examination of sputum for tubercle is also undertaken, and these facilities are generally appreciated by the medical profession.

Port Preventive Work.—As Bristol enjoys considerable foreign trade, liability to ship-brought infection has to be carefully guarded against, especially as the introduction of smallpox by ship is not infrequent, and cholera was, in 1866, imported here directly from the Continent. During the Cholera Epidemic of 1892 it was found necessary, in order to carry out the Cholera Order efficiently, to provide a steam launch for boarding vessels arriving in Kingroad from foreign ports; Gloucester ships from infected ports passing through Bristol waters are also boarded and examined in Kingroad. At the same time a hospital ship was also provided and fitted up for the isolation of ship-brought disease. During the summer and autumn months, when cholera is prevalent, the launch is on day and night service, with a medical officer on duty. At other times the Port Inspectors board and examine vessels taking the river or entering the docks.

The table on next page shows at a glance the effect, in regard to certain of the communicable diseases, of the progressive development of preventive medicine during a period of forty years. Cholera has died out as a factor in our annual mortality, though its introduction is still jealously guarded against in our port arrangements. The extent of smallpox prevalence in the earlier years of this period is hardly to be grasped from the quinquennial averages, high though they are, the *deaths* from this disease alone numbered 214 in 1858, 335

in 1864, and 209 in 1872; figures which we now consider excessive as representing *cases*; and the far smaller mortality of recent years includes the epidemic outbreaks of 1887-88, of 1893-94, and the period of the 1896 outbreak in the neighbouring city of Gloucester. In the case of this disease, notification, segregation and disinfection share the credit of successful control with efficient vaccination; but in the case of scarlet fever, where no such prophylactic measure intervenes, we have a still more striking example of improvement; an improvement, too, in which the most satisfactory results of recent years correspond in point of time exactly with the possibility of control afforded by general notification, and with the extension and utilization of the available means for hospital isolation. It is hardly possible to realize to-day the sorrow and suffering meant by the scarlet fever mortality figures of 1863 or of 1870, when 925 and 746 deaths respectively were recorded from this disease alone in a single year.

AVERAGE YEARLY DEATHS IN BRISTOL FROM CERTAIN OF THE PRINCIPAL ZYMOTIC DISEASES FOR THE 40 YEARS 1858 TO 1897.

CENSUS 1871—182,000. CENSUS 1891—222,000.

QUINQUENNIAL PERIOD.	AVERAGE YEARLY DEATHS.				
	SMALL-POX.	SCARLET FEVER.	FEVER.	DIARRHŒA.	DIPHTHERIA.
1858-62	45	195	148	173	24
1863-67	90	260	207	193	28
1868-72	52	232	119	204	25
1873-77	26	170	101	151	12
1878-82	0·2	120	56	122	7
1883-87	6	79	28	108	22
1888-92	5	39	28	90	22
1893-97	8	29	27	118	42

The fever mortality includes typhus and typhoid (enteric) fever. Typhus, which at the commencement of Public Health Control in Bristol in 1865 was endemic and fatal, practically disappeared in 1878, and since 1890 has been quite absent from the city. Typhoid (enteric) fever shows also a satisfactory diminution; its occurrence is occasional, and it has only prevailed epidemically upon two occasions

within the last twenty years. On each occasion the specific poison was introduced from without and distributed by means of infected milk. The method of introduction was able in both instances to be promptly traced, and the extension of the disease was at once checked ; so, as the general sanitary condition of the City offers no facilities for the continued prevalence of "fever," these chance introductions affected neither the mortality rate nor the healthiness of Bristol or Clifton.

The only figures showing a marked and continuous rise for recent years are those for diphtheria. Although the increased mortality returns from this disease may partly be due to improved diagnosis, there appears, after allowance is made for this, to be a real increase in its prevalence ; and although the increased rate in Bristol, which rose in 1896 to 16 per 100,000 living, is regrettable, it is satisfactory to find that this is well below the average rate for the thirty-three large towns, which amounted to 38 per 100,000 living.

COMPARATIVE MORTALITY RETURNS, 1896.
TWELVE LARGEST ENGLISH TOWNS.

	1896 Population.	Persons to an Acre.	Per 1,000 Population. Birth Rate.	Death Rate.	Zymotic Rate.	Fever Death Rate.	Diarrhœa Death Rate.	Infant Mortality Per 1000 B'ths.
London ..	4,421,955	59·2	30·2	18·6	3·14	0·14	0·72	161
Liverpool ..	632,512	47·8	34·9	22·7	3·01	0·32	1·16	173
Manchester ..	529,561	41·0	33·0	22·6	3·42	0·23	0·94	176
Birmingham ..	501,241	39·5	32·6	20·8	3·57	0·21	1·20	197
Leeds	402,449	18·7	30·7	18·8	2·28	0·21	0·69	169
Sheffield ..	347,278	17·7	34·0	19·3	2·91	0·29	1·02	173
West Ham ..	261,297	55·5	32·6	16·1	3·00	0·23	0·81	165
Bristol ..	**230,623**	**49·3**	**27·6**	**16·9**	**1·90**	**0·08**	**0·52**	**142**
Nottingham ..	229,775	21·0	28·9	17·5	2·47	0·34	0·69	168
Bradford ..	228,809	21·2	25·5	16·5	1·58	0·12	1·38	143
Hull	220,844	26·8	31·9	18·9	3·32	0·28	0·90	173
Newcastle ..	212,223	39·5	31·1	18·5	2·08	0·15	0·51	165
Average 33 Large Eng. Towns ..	10,846,971	35·1	30·7	18·9	2·86	0·19	0·79	167

THE BOTANY OF BRISTOL.

By J. W. WHITE, F.L.S.

For natural history purposes the neighbourhood of Bristol may fitly be regarded as co-extensive with the area of the Bristol coal-fields and the associated strata comprised in the geological map of Mr. Sanders. A district thus limited has already been adopted by local geologists, entomologists and botanists, in pourtraying the Bristol features of their respective branches of science; and to the student it is an undeniable advantage to carry on field work of this kind within boundaries which are substantially natural, instead of drawing an entirely arbitrary line around the city taken for a centre. We speak of the Bristol district, therefore, as bounded on the west by the Severn and the Bristol Channel; on the south by the river Brue, which falls into the mouth of the Parrett just below Burnham; as extending north to the town of Berkeley; and east to the cities of Bath and Wells. Portions of North Somersetshire and of West Gloucestershire make up this area, and are separated, save for a short distance, by the river Avon, which, passing through Bath and Bristol, joins the Severn at Avonmouth. Obviously we have here an extensive tract of country to work over. However, one may justly say that every part of it is not only of great interest to the naturalist, but is easily accessible from Bristol. In these days facility of locomotion is so great, that a run of ten or fifteen miles out and home in any direction can be effected by everyone who has half a day to spare, without undue fatigue or expenditure. Moreover, our chief botanical wealth lies close at hand. Upon St. Vincent's Rocks and on the Downs, in the Avon Gorge, Leigh Woods and the Frome Valley, the stranger who visits Bristol in search of plants, while rambling amid delightful scenery, will become acquainted with many of the greater rarities. Before mentioning these plants in detail it will perhaps be well, for the benefit of readers unfamiliar with the country, to give a brief

topographical sketch of its natural features and surface condition.

The city of Bristol lies in a triangular basin at the confluence of the rivers Avon and Frome, the latter a small tributary from the north-east, which flows through the picturesque Glen Frome, and is not to be confounded with the larger stream passing by the town of that name. Around the city arise hills that are more or less broad table-lands or plateaux. The steep acclivities on the north and west are chiefly masses of carboniferous limestone. To the south the swelling slopes of Knowle and Totterdown extend towards the Dundry range which rises to 769 feet above mean sea level, and bounds the horizon for a considerable sweep. On the east a wide expanse of coal measures containing many pits, and near Bristol overlain by Trias, extends from the river Frome to the cliffs that overlook the Avon at Conham and Brislington. The influence of the tide is shut off near this spot, and the Avon, being locked, becomes a canal. Beyond Bath, however, the canal separates from the river to join the Kennet and Thames system, and thus formed, before the development of railways, one of the more important links of inland navigation between Bristol and the metropolis. Travelling eastward towards Bath the riverside scenery and botany are more commonplace, although in this direction there occur a few species not to be found elsewhere in the district. In its tidal course to the Severn below Bristol the Avon passes by the Hotwells, and onward through a limestone gorge to an extensive tract of alluvial flats drained by numerous intersecting ditches, chiefly brackish. These abound with algæ and other interesting matter for investigation. Other principal sources of drainage in the district are the Chew, the Trym, and the Axe. The former runs through rich pastures between Dundry and the Mendips, by way of Chew Magna and Stanton Drew, falling into the Avon at Keynsham.

Most excellent botanizing is to be had throughout the Chew Valley. The good plants to be gathered include several violets, *Helleborus viridis*, *Stellaria umbrosa*, *Vicia bithynica*, *Lathyrus Nissolia*, *Rubus fissus*, *R. sulcatus*, *R.*

raduloides, *Epilobium roseum*, *Senecio saracenicus* in profusion, *Inula Helenium*, *Mentha sylvestris*, *M. piperita*, *M. rubra*, *M. paludosa*, *Polygonum Bistorta*, *Daphne Laureola*, *Populus canescens*, *P. tremula*, *Juncus compressus*, *Calamagrostis Epigeios*, *Carex acuta*, and *C. strigosa*.

Besides the already mentioned Dundry, there are in the vicinity of Bristol some isolated hills of lower altitude. But the chief elevations are on the Mendip range, a few miles to the south-east, and among the southern spurs of the Cotswolds, which come down into the north-eastern portion of the area as far as Wotton-under-Edge. The latter afford some enjoyable rambles from stations on the Midland Railway, being sometimes wooded, and sprinkled with abundance of belladonna, lily of the valley, Solomon's seal, and good orchids; or open and grassy, decked with patches of *Hippocrepis*, *Trifolium medium*, *Verbascum nigrum* and many roses. Among these Cotswold spurs there occur about a dozen species not to be found elsewhere about Bristol, including the very rare *Stachys alpina*, that grows nowhere else in Great Britain. The Mendip Hills are, for the most part, huge masses of Mountain Limestone, with cores of Old Red Sandstone, rocky and precipitous in places, but chiefly presenting rough pasture and rugged slopes, easily accessible. The levels vary up to the top of Black Down, a wide tract of elevated open moor and heath rising to an altitude of over 1,100 feet. The only true bog we possess occurs upon this range. In consequence, we find on Mendip several paludal species that are peculiar to that locality; for example, *Viola palustris*, *Peplis portula*, *Scutellaria minor*, *Vaccinium Oxycoccos*, *Eriophorum vaginatum*, and *Scirpus pauciflorus*. Other noteworthy plants associated with these hills are *Helleborus fœtidus*, *Viola villosa*, *Thlaspi occitanum*, *Alsine verna*, *Herminium Monorchis* and *Carex montana*. Cheddar deserves to be treated separately on account of the great natural phenomena there exhibited, and the exceptional richness and peculiarity of its flora. The grandeur of its cliffs and caverns attract many travellers from afar; and the delight of a botanist is great indeed when, for the first time, he sees above and around him fine tufts of the beautiful

Cheddar Pink, conspicuous with colour, nestling in clefts and crannies of the heights. Underneath by the roadside are *Sedum rupestre* (*majus*), *Saxifraga hypnoides* forming a matted mantle over the rocks; and, earlier in the year, *Cochlearia officinalis* with *Cerastium pumilum*. Here and there large yellow blossoms of *Meconopsis* make a brave show, and the limestone screes bear abundance of *Phegopteris Robertiana*. If his vasculum be not yet filled to repletion, the student may venture on the critical task of determining how many forms of Thalictrum or of Hieracium, grow at Cheddar; and should he do so, it is not lack of material that will hinder a satisfactory conclusion.

Below the zone of undulating moorland, breezy heath, and old grey rock, there are many little rivulets winding down the boggy slopes until lost in the sphagnum where the sundews grow; and stretches of aboriginal copsewood shelter many sylvestral plants. *Lithospermum purpureo cæruleum* makes its home on the sunny borders of these woods. The splendid hue of its petals, its porcelain fruit, and remarkable mode of growth—the barren stems arch over and root at their tips,—give this plant a high place in our estimation, apart from its rarity. Here too the Bee Orchis makes a profuse display when it chooses; but, as is well known, the appearance of most orchids is uncertain and seemingly capricious.

The Mendips in Somerset and the Cotswolds in Gloucestershire alike, each overlook a great alluvial plain, stretching away westward to the Severn and the Bristol Channel. Reclaimed from the sea at some distant date, these extensive tracts are now fertile pastures, rich in aquatic and paludal species that find congenial stations in the frequent marshes, pools and sluggish drains. Approaching the Channel shore, numerous tidal inlets locally termed "Pills" materially add to the number of our plants, and influence, in some degree, the character of the vegetation to a considerable distance from their waters. About their banks such plants as delight in a saline soil or atmosphere, but shun the exposure of the open coast, find suitable resting places. The coast itself, a long and little varied line of sand

and mud bank, with now and then a low cliff or a bank of shingle, offers all the conditions required by many maritime species.

From what has been stated, it will be evident that the neighbourhood of Bristol possesses a widely varying physical configuration and geological structure, and furnishes nearly every kind of locality that a botanist desires for his researches. One may even say that the additions of mountain and bog are mainly all that are required to render the Bristol district a typical portion of Great Britain. The distribution of plants being largely dependent upon the nature of these features, the flora is, as might be expected, proportionately extensive.

The "Flora of the Bristol Coal-fields," published by the Bristol Naturalists' Society, with its supplements, contains records of about 1,020 flowering plants and vascular cryptogams, excluding a number of varieties, aliens and casuals. To that work all those enquirers may be referred who desire to become more closely acquainted with our plants in their respective habitats. Four species found in the district do not grow elsewhere in Britain. They are *Dianthus cæsius*, *Stachys alpina*, *Arabis stricta* and *Allium sphærocephalum*, the last being peculiar to St. Vincent's Rocks and Durdham Down. The pink is also a limestone plant, but grows only on Mendip, where it is still abundant. *Arabis stricta*, the Bristol rock-cress, is to be found in fair quantity about the rocks overlooking the Avon; and, more sparingly, on the opposite bank of the river, so that it can be claimed by Somerset as well as by Gloucestershire; but its whole area is extremely small, and it behoves all true botanists to use extreme care in dealing with it. *Stachys alpina* was unknown in Britain before the summer of 1897, when it was detected on the hills of West Gloucester by Mr. Cedric Bucknall.

The Downs, rocks and quarries on the banks of the Avon below Bristol yield most of the limestone species, including many of our best plants. Besides those already mentioned, there are met with on St. Vincent's Rocks *Hutchinsia petræa*, *Arabis hirsuta*, *Cheiranthus Cheiri*, *Hippocrepis comosa*, *Pyrus Aria*, *Sedum Telephium*, *Rubia peregrina*,

Blackstonia perfoliata, *Rumex pulcher*, *Allium vineale (compactum et bulbiferum)*, *Geranium sanguineum*, *G. rotundifolium* and *G. columbinum*. On some of the ledges can be seen *Sedum rupestre (minus)*, flowering but rarely, and it occurs also on the other side of the river. The ivy clothing some of the precipices is much infested with *Orobanche Hederæ*, while the handsome *Veronica hybrida* is plentiful, but mostly out of reach. The Alexanders, Parsley and Fennel may perhaps remain from ancient cultivation, and be descended from pot-herbs used by the hermit who, tradition says, at one time inhabited the Giant's Cave. Early in the spring the flowers of *Potentilla verna* are seen in profusion, and for a week or two one can readily distinguish the spikes of *Carex humilis*. After flowering, the sedge blends its foliage with the turf, and entirely justifies its specific name. If the season be damp and cool, *Cerastium pumilum* is fine and abundant, but a hot dry spring restricts the development of such tiny annuals. *C. semidecandrum* grows about the edges of the paths and under the seats, while a dwarf form of *C. tetrandrum* is to be found in the turf near the "Observatory," together with several trefoils and the rarer *Trigonella*. These likewise grow all together on Brandon Hill. The Autumnal Squill was lost sight of for many years after the construction of Clifton Suspension Bridge, but happily has now been re-discovered within a short distance. On the Downs and the rocky slopes towards the river near Sneyd Park are many rare plants, including Columbine, Honewort, and the rosy-tinted Dropwort always scenting the purest air. The best grasses are *Gastridium*, *Triodia*, *Koeleria*, *Avena pubescens*, *A. pratensis*, *Festuca myurus*, *F. sciuroides*, *Bromus erectus*, *B. madritensis* and *Brachypodium pinnatum*. All these grow within a very small area. The Fly and Bee Ophrys have become scarce, but Lady's-tresses are scattered freely on the Downs. In furzy spots we find *Ulex Gallii*, *Carex pulicaris*, *C. pilulifera* and *C. panicea*, which flourishes alike on limestone or in marsh. *Carex digitata*, as a rule, is well concealed under bushes, and wants a good deal of looking for. In Leigh Woods it is larger and more abundant. Further westward

beyond the limestone there occur on the river bank many other interesting species, from which may be selected for mention *Allium oleraceum*, *Trifolium maritimum*, *Lathyrus Nissolia*, *Bupleurum tenuissimum* and *Alopecurus bulbosus;* while in the marsh ditches about Avonmouth and Lawrence Weston are plenty of *Batrachia*, *Ruppia*, *Zannichellia* and Algæ.

The medical botany of the district is well worthy of a paragraph. Among all the fetid, acrid, venomous, and yet most handsome plants that are gifted with health-restoring, or baleful, fatal qualities, Hellebore and Aconite stand first. Of the former genus the two British species are rare plants, but both occur near Bristol; and Monkshood is decidedly and abundantly naturalized—if indeed it be not native, on the banks of some Somerset streams. Thickets of hemlock stand on many shady river banks; gorgeous fox-gloves give a special feature to the sandstones wherever they crop up: and Colchicum is conspicuous over the whole expanse of Mendip. Henbane, essentially a maritime plant, can always be met with between Brean Down and Burnham; though its re-appearance at any given spot is never to be relied on. Among the wild hills of West Gloucestershire, Belladonna lurks in profusion. Two plants of it, also, are known within the recesses of Leigh Wood; where Convallaria covers about an acre of limestone rock. Of beautiful Daphnes and "bonny, bonny Broom," with many of the more ill-favoured officinal weeds whose virtues are but lightly esteemed in modern medicine, little need be said. They all grow about Bristol; and had the cancer-healing pretensions of the greater Celandine been amply justified, its yellow juice could have been procured in quantity for treatment.

To the deficiency of arable land may be attributed the absence of some agrarian weeds common in more highly cultivated portions of the kingdom. Very much of the land around Bristol is unsuitable for the plough. Speaking generally, the owners profit most by allowing it to remain in its original state, either as woodland or for grazing. And here comes in the consolatory thought that during the last half-century, cultivation has not threatened to reduce the

number of our plants: the extinction of *Cyperus longus* in Somerset being scarcely a case in point. But the advance of bricks and mortar in the expansion of our towns wears another aspect; there being little doubt that a great local rarity—the *Linosyris*, was built over at Weston-super-Mare a generation ago. However, beyond these two instances, we believe that no species correctly reported as native in our area has become extinct, although with some existence is precarious. *Thalictrum minus* was known by Sole in the last century to occur in small quantity on Durdham Down. This rare plant is now represented at Bristol by *one root*, very much at the mercy of scrambling boys. *Scirpus Holoschœnus* in Somersetshire covers one square foot of ground, and *Eryngium campestre* perhaps six times as much.

Ferns are scarce about Bristol, and are receding farther from the city since their cultivation became a fashion. If the ruthless uprooting and transference to death in a garden continue, we may bye and bye have only a few fronds of bracken left. *Ceterach* is a feature of local botany, and one of the prettiest ornaments of our limestone walls. *Cystopteris* and *Osmunda* formerly grew in Leigh Wood; but for the first, one must now go in the direction of the Mendips, where it is frequent; and for the second, to the peat moor, on the southern limit of the district. On the peat grow also *Lastræa Thelypteris* and *L. spinulosa*. There is some evidence that *Polypodium Dryopteris* once grew in Leigh Wood; the place has been pointed out, but the fern is no longer there. *P. Phegopteris* is known in one spot near Wells; and a station for *P. Robertianum* has been already mentioned. *Asplenium lanceolatum*, on sandstone rocks in Glen Frome, is in danger of the fate allotted by collectors to all good things. Ten years ago it was only obtainable with the aid of a quarryman and a rope.

Leigh Wood is the great hunting ground for mosses, yielding as many as 200 species. Some very rare musci also, including *Grimmia orbicularis* and *Tortula Hornschuchiana*, are to be found on Durdham Down. Mr. Cedric Bucknall has catalogued a very large number of Bristol fungi, some new to Britain, and a few new to science. The latter include

Agaricus Bucknalli, and are described and figured in the "Transactions of the Bristol Naturalists' Society."

The rich botanical resources of one of the most delightful and interesting districts in the kingdom are but lightly indicated in this imperfect sketch. Finality in field-botany is fortunately unattainable, for therein lies the charm of research: the keen anticipation of discovery lends zest to the pursuit, and stimulates each fresh generation of workers to outdo those that have gone before.

THE BIRDS OF THE BRISTOL DISTRICT.

By HERBERT C. PLAYNE, M.A.

It may be well to state at the beginning of this account of the Birds of the Bristol district, that it is intended not to be a record of all the species which have occurred in the neighbourhood of Bristol, but rather to give to visitors interested in birds some idea of the ordinary bird life of the district which they are visiting. A complete list of all species which have occurred in the neighbourhood is in preparation by the Ornithological Section of the Bristol Naturalists' Society, and it is chiefly from information supplied by members of that section that these notes have been compiled.

The varied nature of the country round Bristol makes it possible to see many species in a day's walk, since one can easily pass from hills exceeding 500 feet in height through well-wooded and watered valleys to the flat meadows bordering on the rivers, and to the sand and mud banks of the tidal rivers themselves. At no great distance, too, are the Somersetshire peat moors, low lying land of considerable extent, which is still a breeding ground of such interesting birds as the Shoveller (*Spatula clypeata*) and the Spotted Crake (*Porzana maruetta*).

It is by the small summer visitors that we are most favoured, for from the day on which the Chiffchaff first feebly makes himself heard in Coombe Dingle, these birds and their relations seem to pour into the country. In the flat fields by the side of the Severn one can watch the march of the Chiffchaffs along the hedges, all of them moving in one direction, from which they will not be turned back. If one stands in their way, they only fly past and continue their journey; it is impossible to frighten them in the other direction.

Curiously enough, in some years the first arrivals appear to be moving down the Severn valley, having come across

the country perhaps from the east coast, while in other years they are seen to be travelling in exactly the opposite direction, as though from the south coast. It may be that the weather sometimes favours one route more than the other. If one may judge from the casualties at the lighthouses, there is not much nocturnal migration near the eastern shore of the Bristol Channel, for in answer to inquiries we were told that at Avonmouth one Starling had been killed in nine years, and at Burnham, "now and then a Blackbird or a Thrush." During the latter part of March successive parties of Wheatears (*Saxicola œnanthe*) on migration rest upon Durdham Downs, but they no longer remain there to breed as they used to do in numbers in 1860.

Of the Thrushes family the three common species are abundant throughout the year, though there is a considerable increase in the number of Blackbirds (*Turdus merula*) on the Downs in the autumn. Redwings (*T. iliacus*) and Fieldfares (*T. pilaris*) are to be seen every winter, and occasionally Ring Ouzels (*T. torquatus*) have appeared on migration in spring. In places such as Cadbury Camp where there is gorse, a few Stonechats (*Pratincola rubicola*) breed, but the Whinchat (*P. rubetra*) is more common in the neighbourhood, especially in the meadows of the flat country, where it nests in the banks of the ditches.

Redstart (*Ruticilla phœnicurus*), Nightingale (*Daulias luscinia*), both Whitethroats (*Sylvia cinerea*, *S. curruca*), Blackcap (*S. atricapilla*), Garden Warbler (*S. hortensis*), Chiffchaff (*Phylloscopus rufus*), Willow Wren (*P. trochilus*) all nest on the Downs, and the Wood Wren (*P. sibillatrix*) is abundant in the Leigh Woods; the Blackcap sometimes stays in the neighbourhood during the winter. In January, 1895 a Black Redstart (*Ruticilla titys*) was observed, on the river bank near Sea Mills and was subsequently shot; a bird of the same species had frequented the same spot during the two previous winters.

In the osier beds and in the thick hedges growing over the ditches in the lower ground Sedge Warblers (*Acrocephalus phragmitis*) are plentiful, but the Reed Warbler

(*A. streperus*) is not so well distributed, though numerous enough in certain favourite haunts. The Marsh Warbler (*A. palustris*) is a regular visitor to a certain spot between Bristol and Bath, where the nest has been found three times in the last four years; there was also another pair of these birds in 1897 on the other side of the city. That curious bird the Grasshopper Warbler (*Locustella nævia*) is to be found in several places in the neighbourhood, both among the gorse on a dry common and among the tangled herbage of the osier beds. They are very inquisitive birds, and if one lies down on the ground not far from their nest they will come round silently and will creep almost upon one's body. The sitting bird certainly flies from the nest at times, though much more frequently does she creep away quietly along the ground, especially if the nest is often visited.

Five species of Titmouse, as well as the Nuthatch (*Sitta cæsia*) and Tree Creeper (*Certhia familiaris*) are abundant throughout the district. Besides the Pied and Yellow Wagtails (*Motacilla lugubris*, *M. raii*) a few pairs of Grey Wagtails (*M. melanöpe*) breed in the neighbourhood, and in the winter these most graceful birds can always be found by the banks of the Trym and other streams; one often haunts the Zoo pond. The Meadow Pipit (*Anthus pratensis*) is resident, though much more abundant in the winter, but many Tree Pipits (*A. arboreus*) visit us in summer, and the Rock Pipit (*A. obscurus*) also is resident, nesting on the Sea Walls.

The Red-backed Shrike (*Lanius collurio*) is to be seen on many a hedgerow, especially on those which have mowing grass on one side of them, for that makes sure of a good supply of insect food. Spotted Flycatchers (*Muscicapa grisola*) are common, but the Pied (*M. atricapilla*) has nested only rarely in the district.

Hawfinches (*Coccothraustes vulgaris*) have increased in number considerably within the last few years, and now during the winter can be seen even on Brandon Hill. In the early spring their curious attempt at a song may be heard at almost any time among the hawthorns on the slopes of the Downs, but during the summer these birds are more

difficult to see, though a good many breed in the neighbourhood. In the winter, Siskins (*Chrysomitris spinus*) haunt the alders, and Bramblings (*Fringilla montifringilla*) are often among the flocks of Chaffinches. The Lesser Redpoll (*Acanthis rufescens*), like the Hawfinch, seems to have become more common, and is now quite abundant throughout the year ; it nests on the Downs as well as on the Somersetshire side of the Avon. Winter visits of Crossbills (*Loxia curvirostra*) are uncertain though not infrequent, and perhaps the same may be said of the Snow Bunting (*Plectrophanax nivalis*). Four other Buntings are resident, but the Reed Bunting (*Emberiza schoeniclus*) as a rule only inhabits the lower ground, while Cirl Buntings (*E. cirlus*), though fairly distributed, are not so numerous as the others.

The commoner species of Corvidæ are as numerous as could be expected in a game preserving country, and the Hooded Crow (*Corvus cornix*) has appeared on a few occasions. The Nightjar (*Caprimulgus europæus*) nests quite near to the city, and can be heard "churring" in the woods across the river from the Downs. On a certain rock among the gorse on Cadbury Camp a male Nightjar has rested during the daytime for four successive summers.

The Wryneck (*Iynx torquilla*) and three Woodpeckers (*Gecinus viridis*, *Dendrocopus major*, *D. minor*) are fairly common in the district. A pair of Great Spotted Woodpeckers have in two following years reared a brood close to a much frequented path in the Leigh Woods, though in the first year they were twice cut out of the hole they had made, and were only successful when with great perseverance they made a third attempt. The young birds in the nest make an incessant noise, which it is difficult to describe, and they will not be silent even when their parents "tchick" their loudest. This noise made by the young is enough to attract attention to the nest.

In birds of prey the neighbourhood is not rich, for even the commoner species are kept down; but a Peregrine Falcon (*Falco peregrinus*), perhaps from Lundy, now and then makes a descent upon a Bristol pigeon, and the Merlin

(*F. æsalon*) is sometimes caught by birdcatchers when it has made a dash at their call bird. By the river banks and the shore of the Bristol Channel several rarer species have not infrequently been obtained, but here let it suffice to say that the commoner Gulls and Waders are often to be seen near Avonmouth. Many Black-headed Gulls (*Larus ridibundus*) and some Kittiwakes (*Rissa tridactyla*) haunt the Avon close to the city except during the nesting season, and in hard weather Ringed Plover (*Ægialitis hiaticula*) and Dunlin (*Tringa alpina*) have come up to the entrance of the Bristol docks. The Sheld-duck (*Tadorna cornuta*) breeds along the coast of the Channel, and can frequently be seen on the mud banks. At times, too, Manx Shearwaters (*Puffinus anglorum*) appear, and several of them one stormy day were skimming over the waves between Avonmouth and Chepstow.

In conclusion, it may be said that, considering the large city in its midst, this neighbourhood is rich in the bird life which may, under ordinary circumstances, be seen in it during the year, and when the list of all the local species is completed, it will be found to contain many interesting records.

THE REPTILES, AMPHIBIANS AND FISHES OF THE BRISTOL DISTRICT.

By H. J. CHARBONNIER & C. LLOYD MORGAN.

THE following is a brief record of the four species of reptiles, five of amphibians, and twenty-seven of fishes, which are on record for the Bristol district.

Class: *Reptilia.* Order: *Squamata.* Sub-order: *Lacertilia.* Family: *Lacertidæ.* The common lizard (*Lacerta vivipara*) is fairly abundant in all suitable localities, such as hot, dry and sandy places amongst furze and heath, for example at Leigh and Brockley, and on our Downs. Family: *Anguidæ.* The slow-worm or blind-worm (*Anguis fragilis*) is common with us in fields and hedge-rows especially near Wick. One of us (H.J.C.) has seen a specimen in which the upper part of the neck and back was irregularly sprinkled with bright blue spots.

Sub-order: *Ophidia.* Family: *Colubridæ.* The ringed snake (*Tropidonotus natrix*) is fairly common in marshy grounds, and may frequently be seen swimming in ponds, and the Somersetshire rhines. Family: *Viperidæ.* The viper or adder (*Vipera berus*) is not uncommon in dry and heathy soil, as at Brockley Combe. One of us (H.J.C.) has seen the variety sometimes called the "red viper" of a bright ferruginous colour with dark mahogany markings. Its head is broad and short. Class: *Amphibia* (*Batrachia*). Order: *Anura* (*Ecaudata*). Sub-order: *Phaneroglossa.* Family: *Ranidæ.* The common frog (*Rana temporaria*) is abundant on all marshy grounds, though its numbers have diminished. Family: *Bufonidæ.* The toad (*Bufo vulgaris*) is very abundant.

Order: *Urodela* (*Caudata*). Family: *Salamandridæ.* The great crested water newt (*Molge cristata*) is fairly common in ponds and ditches. The young, 2¾ inches long, are occasionally found under stones, the belly being pale yellow without the maculations of the adult. The smooth newt

(*M. vulgaris*) is very common in every pond and ditch. The tadpoles leave the water as early as the end of July, having by this time lost their gills, and crawl about under stones and among grass tufts in damp places. They hibernate in an old stone wall or similar place, sometimes at a considerable distance from the water. The webbed or palmated newt (*M. palmata*) is fairly plentiful in the Somersetshire part of the district, and in ditches and ponds at Keynsham. The young leave the water much later in the season, retaining their gills till the end of September.

Class: *Pisces.* Sub-class: *Teleostei.* Order: *Actinopterygii.* Sub-order: *Acanthopterygii.* Family: *Percidæ.* The perch (*Perca fluviatilis*) is abundant in the Avon, Frome, Chew, and other suitable streams in the district. The pope or ruff (*Acerina cernua*) does not occur in the Avon, but is abundant in the Berkeley canal and in the Stroudwater canal — especially in the lower section. Family: *Cottidæ.* The miller's thumb or river bullhead (*Cottus gobio*) occurs in most of the small streams and brooks in our neighbourhood, most often under or amongst stones. Family: *Gasterosteidæ.* The three-spined stickleback, or thornie (*Gasterosteus aculeatus*) is very abundant in the rivers and brooks of the district. The ten-spined (or nine-spined) stickleback or tinker (*G. pungitius*), occurs in ditches at Avonmouth.

Sub-order: *Anacanthini.* Family: *Pleuronectidæ.* The flounder (*Pleuronectes flesus*) is abundant in the Avon and Chew. In the former river it has been recorded as high as within three miles of Bath.

Sub-order: *Physostomi.* Family: *Salmonidæ.* The salmon (*Salmo salar*) occurs in the Severn. We are informed that it has occurred as high up the Avon as the Suspension Bridge. The trout (*S. fario*) is fairly common in the Avon and its tributaries, and is not unfrequently caught of good size—six or seven pounds and over. Family: *Esocidæ.* The pike or jack (*Esox lucius*) occurs commonly in the Avon, and used to be caught of large size, but not of late years. Family: *Cyprinidæ.* The common carp (*Cyprinus carpio*) occurs in the Avon, but is not now

caught of large size. The gudgeon (*Gobio fluviatilis*) is common in the Avon and its tributaries. The tench (*Tinca vulgaris*) is found in ponds where, however, it has in most cases been introduced. It occurs also in the Avon above Bath, but is very rare in the lower reaches. The dace (*Leuciscus vulgaris*) is common in the Avon and its tributaries, as are also the roach (*L. rutilus*) and the minnow (*L. phoxinus*). The chubb (*L. cephalus*) is found in the Avon, but is more common above Kelston than below; it is sometimes caught of fair size—six to seven pounds. The bream (*Abramis brama*) does not occur in the Avon, but is abundant in the Gloucester and Berkeley canal. The bleak (*Alburnus lucidus*) is fairly abundant in the Avon. The silvery pigment underneath the scales used to be employed in the manufacture of artificial pearls; the argentine of the Tiber is now used for this purpose. The common loach (*Nemachilus barbatulus*) has been taken in the streams in Ashton meadows and in streams (under stones) at Keynsham.

Family: *Clupeidæ*. The anchovy (*Engraulis encrassicholus*), the sprat (*Clupea sprattus*) and the shad (*C. alosa*) are common in the Severn. The twaite shad (*Clupea finta*) is also found in the upper parts of the Severn. Family: *Muræenidæ*. The fresh-water eel (*Anguilla vulgaris*) in both its sharp nosed and broad-nosed varieties, occurs abundantly in the Avon and other streams. Tens of thousands may be seen in their spring migration working up stream as minute "elvers" which are caught in great numbers and fried. During the autumn migration very many—especially of the sharp-nosed variety—are taken in the weirs of the Chew, as many, it is said, in a single night as to weigh two tons. The conger (*Conger vulgaris*) is found at Sharpness.

Class: *Cyclostomata*. Sub-class: *Marsipobranchii*. Family: *Petromyzidæ*. Both the sea lamprey (*Petromyzon marinus*) and the river lamprey (*P. fluviatilis*) occur in large numbers in the Severn. But they are not, so far as we know, recorded for the Avon.

THE MAMMALS OF THE BRISTOL DISTRICT.

By H. J. CHARBONNIER and C. LLOYD MORGAN.

THIRTY-THREE species belonging to twelve families and four orders of indigenous mammals are on record as occurring in the neighbourhood of Bristol. In this list we have omitted such forms as the wild cat (of which there is no recent record, though in the reign of Henry I., Thomas de Berkeley received a grant to hunt the wild cat among other animals in Kingswood Chace), and occasional drifted whales, such as the common fin whale (*Physalus antiquorum*), which came ashore on Jan. 15th, 1835, at Littleton Pill, on the east bank of the Severn.

Order: *Rodentia.* Sub-order: *Simplicidentata.* Family: *Sciuridæ.* The squirrel (*Sciurus vulgaris*) is fairly abundant in the neighbourhood.

Family: *Myoxidæ.* The dormouse (*Myoxus avellanarius*) is also not uncommon, but is more frequently found on the Somersetshire than on the Gloucestershire side of the Avon.

Family: *Muridæ.* Sub-family: *Arvicolinæ.* The water vole (*Arvicola amphibia*) is common. A black variety occurs in the Avon. One of us (H.J.C.) has observed a water vole in the Trym attempting to drag into the stream a young rabbit larger than itself. It has also been observed to climb nut bushes and carry off the nuts. The meadow vole (*A. agrestis*) is also abundant; and the bank vole (*A. riparia*) though generally rare was very abundant in Leigh Woods in 1888. They were seen (H.J.C.) in small scattered parties of eight or ten making their way steadily in one direction down the valleys, perhaps in search of water. Sub-family: *Murinæ.* The brown rat (*Mus decumanus*) is a common pest. The black variety, by some raised to the level of a distinct species (*M. hibernicus*), has been obtained from Lundy Island. The black rat (*M. rattus*) is common in some of the Bristol warehouses. The variety known as *M. Alexandrinus* (by some regarded as a distinct species) occurs

commonly in the ships in the harbour. Its colour is grey or rufous, and the belly white. Numerous crosses between the black and Alexandrine rats are found. The house mouse (*M. musculus*) is common. One of us (C.Ll.M.) has recently had under observation a "singing mouse." The pleasing note was not produced under the influence of fright, nor was it a mere wheezing. It was best heard when the mouse came out to feed in the evening, the lights being low, and seemed to be a voluntary product, as varied as the twittering of some birds, and ceasing the moment the animal was disturbed. The harvest mouse (*M. minutus*) is occasionally found, but is decidedly rare in the Bristol district. The long-tailed field mouse (*M. sylvaticus*) is very abundant in the neighbourhood.

Sub-order: *Duplicidentata*. Family: *Leporidæ*. The hare (*Lepus timidus*) is not nearly so common in the Bristol district as it is in many other parts of England. The rabbit (*L. cuniculus*) is abundant.

Order: *Carnivora*. Sub-order: *Carnivora vera*. Family: *Canidæ*. The fox (*Vulpes communis*) is fairly abundant in those parts of the district where it is preserved. Family: *Mustelidæ*. The otter (*Lutra vulgaris*) has been recorded on both sides of the Avon; and Mr. Witchell states that in 1885 no less than 70 salmon were killed by otters in the Severn. They are still found in Tortworth Park, where they are preserved by Lord Ducie. The martin (*Mustela martes*) is probably now extinct in our district; but in 1829, Knapp in his "Journal of a Naturalist" said "it lingers with us still, and every winter's snow becomes instrumental in its capture, betraying its footsteps to those who are acquainted with the peculiar traces it leaves." About sixteen years ago, Mr. Strugnell saw one which had been shot in the Forest of Dean, and about the same time one was caught at Berkeley. The pole-cat (*M. putorius*) is still, or was till lately, occasionally found near Nailsworth. In 1891, Mr. Witchell saw one which had been killed between Chepstow and Tintern. The weasel (*M. vulgaris*) is still common, as is also the stoat (*M. erminea*). One of us (H.J.C.) has received stoats shot in January in the white (winter) dress and others, shot

at the same time, of the ordinary brown (summer) colour. This has occurred so often that he is led to believe that we have two races, one that changes its colour in winter and one that does not. The Irish stoat, which is by some regarded as of specific rank (*M. hibernicus*) does not change its colour in winter. Since the variable variety is often pure white in very mild winter when there has been little frost or snow, it would seem that the change is determined rather by the time of year than by the direct action of cold. The badger (*Meles taxus*) which used to be common is still a member of the fauna of our district.

Sub-order: *Pinnipedia*. Family: *Phocidæ*. The common seal (*Phoca vitulina*) is occasionally reported from the Severn.

Order: *Insectivora*. Sub-order: *Insectivora vera*. Family: *Erinaceidæ*. The hedgehog (*Erinaceus europæus*) abounds in our district. It is an expert swimmer. One of us (H.J.C.) has seen it drop five feet down a bank and swim straight across the Frome. A female which littered in a cage in June, gave birth to three blind young, the bristles of which did not appear until they were one or two days old and were, at first, soft to the touch. Family: *Talpidæ*. The mole (*Talpa europæa*) is very abundant. It also can swim well if forced to take the water. The mounds of earth they raise are locally known as "want heaves." One of us (H.J.C.) has observed the following varieties in colour of specimens from the neighbourhood; one with large white patches on the body—the white hair being longer than that on the darker parts; one salmon-tinted, nearly white in parts; and one chinchilla gray almost all over, with a salmon-tinted patch on the breast. Family: *Soricidæ*. The common shrew (*Sorex vulgaris*) is fairly abundant. Its voracity is well known. One of us (H.J.C.) when collecting voles and other small rodents has often found his captives half eaten in the morning. The shrews managed to slip through the wires of the trap and attack the prisoner. This was proved by setting small gins in which the shrews were caught. The lesser shrew (*S. pygmæus*), which in Ireland takes the place of our common shrew, is rather rare in the

Bristol district, as is also the water shrew (*Crossopus fodiens*), which one of us (C.Ll.M.) has, however, frequently seen in the Trym, near Coombe Dingle.

Order : *Cheiroptera.* Sub-order : *Microcheiroptera.* Family : *Rhinolophidæ.* The greater horse-shoe bat (*Rhinolophus ferrum-equinum*) occurs in Bristol and Wells Cathedrals and has also been found at Clevedon, in old mines at Westbury, and elsewhere. The lesser horse-shoe bat (*R. hipposiderus*) is somewhat rare, and has seldom been recorded north of the Avon. It has been obtained from Dundry caves and from Westbury-on-Trym. Family : *Vespertilionidæ.* The noctule (*Vesperugo noctule*) is common in old trees in suitable localities, the females being the more abundant. The pipistrelle (*V. pipistrellus*) is common in the Gloucestershire part of the district, but rare on the Somersetshire side of the Avon. The whiskered bat (*V. mystacinus*), on the other hand, is common near Bath. Some hundreds were obtained at Willsbridge, near Keynsham ; and, of twenty or more specimens examined, all were females, several of which had young ones clinging to their fur, and several gave birth to young the next day. These newly-born bats measured about three inches in spread of wing, and were quite naked with pinkish bodies and black heads and wing-membranes. They were apparently quite blind. This bat has also been obtained from the Dundry caves. The long-eared bat (*Plecotus auritus*) is fairly common in both the Gloucestershire and Somersetshire parts of the district. It is more tameable than other bats. Of the barbastelle (*Synotus barbastellus*) one of us (H.J.C.) has received a single specimen from Stroud ; and of Natterer's bat (*Vespertilio nattereri*) a specimen was taken in 1858, at Elmore, by the late Sir W. V. Guise.

THE INSECTS OF THE BRISTOL DISTRICT.

By ALFRED E. HUDD, F.E.S.

THE neighbourhood of Bristol has long been a happy hunting ground for entomologists. Although we have in this part of England no mountains, few marshes and little sea coast, it is probable that the Bristol district is almost as rich in species as any district of similar size in the country.

Of the orders of British insects only three, the Coleoptera, the Lepidoptera and the Hymenoptera, have received much attention from local collectors ; and of only one of these, the Lepidoptera, has a detailed catalogue of the local species been printed. This will be found in the "Proceedings of the Bristol Naturalists' Society,"* and records no less than 1310 species of butterflies and moths as found in the "Bristol coalfield," an area which includes the portion of Gloucestershire south of Dursley, and of Somersetshire north of Wells. This district has added several previously unknown species to the list of British insects, among which *Drepana sicula*, *Miselia bimaculosa*, and some of the *Tineina* have hitherto only been found near Bristol. *D. sicula* was first taken in the Leigh woods in 1837, and after an interval of several years a few more specimens were found there. Of late years few summers have passed without some specimens of this beautiful "hook-tip" having been captured by local collectors, and the larvæ are also sometimes found on the leaves of the small-leaved lime, a tree which is abundant in the Leigh woods, although it is uncommon in most other parts of the country. Of *Miselia bimaculosa* a specimen was taken on Durdham Down, Clifton, in 1815, which still remains the only British representative of a species found quite plentifully in many parts of France and Western Europe, among elm trees.

* "Proceedings B. N. Soc.," n. ser., vols. ii., iii. and iv.

Coleoptera.—This order is fairly represented in the neighbourhood, and many interesting and scarce species have been recorded. On the sea-coast between Portishead and Weston-super-mare, several marine species not found nearer Bristol occur, including *Cicindela maritima*. Several rare beetles are found in the Leigh woods, including *Licinus depressus*, *Hypulus quercinus*, *Strangalia aurulenta*, *Cychrus rostratus*, *Elater balteatus*, *Lomechusa emarginatus*, *Sphodrus leucopthalmus*, *Eros minutus*, *Boletobius exoletus*. On Clifton and Durdham Downs *Tarus axillaris*, *Lebia chlorocephala* and *Oncomera femorata* are taken, and in other places near Bristol the following among other rare or local beetles occur: *Bolbocerus mobillicornis*, *Callidium variabile*, *Cassida murræa*, *Lamia textor*, *Aromia moschata*, *Endomychus coccineus*, *Hylotrupes bajulus*, *Clythra 4-punctata*, *etc.*

The *Brachelytra* have not been much in favour among Bristol collectors, but several rare species have been captured in the neighbourhood.

Hymenoptera.—The Bristol district is especially favoured by the Hymenoptera, nearly all the commoner bees and wasps, with the exception of the hornet, which, locally, is very rare, being abundant. Of the *Bombi*, or social bees, two of the scarcer species—*B. elegans* and *B. cullumanus*—have only been found in one or two other localities. The bees, parasitic upon their social cousins, *Psithyrus* or *Apathus rupestris*, *barbutellus*, *vestalis* and *campestris* have often been captured and probably are very common, but escape observation from their close mimicry of the species they are parasitic on.

Of the solitary bees the genera *Colletes*, *Prosopis*, *Andrena*, *Sphecodes*, *Cilissa*, *Halictus*, *Macropis* and *Dasypoda* are well represented; the very rare *Sphecodes subquadratus*, *Andrena ferox* and *A. aprilina* have been taken in this locality.

The bees which are parasitic upon the solitary tribes, commonly known by the name of wasp-bees from their resemblance to the smaller species of Vespidæ, are very common, even a very local species, *Stelis aterrima*, has been taken near Clifton.

Of the very numerous genera of building and woodboring wasps space forbids more than a bare notice, but *Odynerus melanocephalus* and *O. pictus* have been found near Clifton. There is no doubt but that the neighbourhood of Bristol would, if properly worked, prove a rich ground to the hymenopterist. The workers in this branch are locally very few.

Hemiptera—Homoptera.—Few local collectors have paid any attention to this branch of entomology, but some rare and local species have been found in the district, including *Æliodes inflexa*, *Zicrona cœrulea*, *Acanthosoma griseum* and *pictum*, and *Psallus distinctus*. The rare *Salda pilosa* has been found on the Severn bank, under seaweed, and *Notonecta maculata* in ditches at Ashton.

Of the *Homoptera* the curious *Ledia aurita* occurs at Portbury, *Macropsis lanio* at Shirehampton, and *Tettigonia viridis* on marshy ground at Stapleton.

For the *Mollusca* of the Bristol district see "List of Land and Fresh-water Mollusca of the Bristol district," by Adolph Leipner. (Proc. Brist. Nat. Soc., New Series, Vol. I, Part II, 1874–5.)

EDUCATIONAL ORGANIZATION IN BRISTOL.

By C. W. A. TAIT, M.A.

THE Colleges and Schools of Bristol fall naturally into three great groups: the elder Foundations, such as the Grammar School and the Cathedral School, both of which date back to the reign of Henry VIII.; the Hospital schools, such as the City School, the Red Maids' and Colston's Hospital; and finally, the schools and colleges which have arisen during the present century and almost during the present reign. This last group, which is much the most comprehensive, includes the Bristol College and the Bishop's College, both of which, though they have long ceased to exist, left their mark on the city and still live in the memory of the elder inhabitants; Clifton College, Bristol University College, the Merchant Venturers' Technical College, the four great schools for girls, the Clergy Daughters' School, the Clifton High School, the Redland High School, the Colston's Girls' Day School; the Elementary Schools which the Town Council has connected with the Secondary Schools by a system of scholarships; and, finally, George Müller's Orphanages upon Ashley Down, and the Reformatory and Industrial Schools.

The eldest and the most prominent of the City schools is the *Grammar School.* The exact date of its origin is unknown; it certainly dates back to pre-Reformation times, for it was already in existence in 1532 under a lay master, Thomas Moffett, assisted perhaps by his son Robert Moffett. In that year it was endowed with the estates of the ancient Hospital of S. Bartholomew, in Christmas Street, in virtue of an agreement between the patrons and the clerical master of the Hospital on the one side and on the other Robert Thorne, merchant, of Bristol, and Nicholas his brother, and "the parson of Christ Church," Bristol. It is to be noted that this diversion of the endowment from eleemosynary to educational purposes was prior to the dissolution of the monasteries and clearly had the approval

of the clergy. Robert Thorne dying in that same year, 1532, left £300 to the school, but it was not till 1561 that the property was finally handed over to the Corporation of Bristol as trustees. For about 240 years the school was carried on at the "Bartilmews without the Froom Gate" at the foot of Christmas Steps, where the arch of the old gateway with its Madonna and child may still be seen, though in a sadly mutilated condition. About 1767 the school was moved into Unity Street so as to escape the unhealthy premises near the open Froom; it there remained for more than a century. At the beginning of the century—which was an evil time generally for education—the Grammar School had declined so much that there is a tradition that the Rev. Charles Lee, who was then head master, had for some years only one pupil, commonly called Lee's chick. It is certain, at any rate, that between the years 1812 and 1828 the Grammar School had practically become a private school, and the Grammar School boys were simply the head master's private boarders. In 1836 the Corporation Act replaced the Corporation of Bristol by the Municipal Charity Trustees, and in 1842 the constitution of the school was revised by the Court of Chancery. "The school had by this time fallen," even as a private school, once more into decay, and "the then head master, though still living in the master's house, had for some time received no pupils." The school was, in fact, closed from the year 1844 till the year 1848, when it was re-opened in accordance with the new scheme giving the right of admission to boys living within the boundaries of the city and county of Bristol. From that time its career of prosperity as the great City school has been unchecked. Its scholars have won numerous and distinguished scholarships and prizes at both Universities, and high places both in the military and civil services. Its management was once more modified by the Endowed Schools' Commission in 1875, when it was vested in a governing body composed partly of charity trustees and partly of local representatives. In 1879 the school left the old premises in Unity Street for new buildings in Tyndall's Park, consisting of a magnificent hall capable of

holding an audience of 2,000, with nine class-rooms for teaching and a private house for the head master. Additions were made to the buildings in 1892 so as to provide a second chemical laboratory, a new physical laboratory and a lecture theatre. The transept of the great hall contains the memorial brass of Nicholas Thorne mentioned above, also a fine bronze by G. Frampton, A.R.A., which is a portrait of the late head master, Dr. J. W. Caldicott—to whom not only the Grammar School but the whole city of Bristol owes a deep debt of gratitude—subscribed by his old pupils and friends. The present head master who carries on Dr. Caldicott's work is R. L. Leighton, Esq., Balliol College, Oxford. It is much to be regretted that no register of admissions to school was kept before 1875. The Grammar School is pre-eminently the leading Bristol school and acts up to its great position by providing free entrance scholarships to be competed for by boys in the elementary schools of Bristol; but it also opens its doors to boarders who at present live in the houses of certain of the masters. It is possible that, should the number increase, a hostelry may hereafter be built for their reception.

The second school in Bristol which dates back to Reformation times is the *Cathedral School*. This school formed part of the Cathedral Corporation established by Henry VIII. after the surrender of Abbot Barton to the King's supremacy in 1538. For long, however, the chapter neglected the purposes of this part of their foundation, and it was not till the year 1876 that a real effort was made in the direction of education by establishing a Training College and a Grammar School in connection with the Cathedral. By a further change, in May, 1882, the Training College was suppressed, but the Cathedral School remains and enjoys a high reputation for sound and liberal education. The number of pupils is limited to 120, eighteen of whom are choristers of the Cathedral and are educated free of charge. The head master is the Rev. H. W. Pate, M.A.

The next great group of Bristol schools is that of the Hospital schools. The oldest of these is the *City School*, or Queen Elizabeth's Hospital for Boys. It dates back more

than 300 years, being founded in 1586 by John Carr, soap manufacturer, of Bristol, who, by his will, assigned the Manor of Congresbury in Somerset to the Corporation of Bristol to erect and found a hospital for poor children and orphans, "being men children," in imitation, no doubt, of Christ's Hospital already founded in London. The school was opened in the summer of 1590 with twelve boys. The premises then used were the Mansion-house and orchard of the dissolved "Hospital of the Gaunts"—the site afterwards occupied by the Grammar School and now occupied by the Merchant Venturers' College. The liberality of the Corporation in making gifts to the amount of £3,000 to further the designs of the founder obtained from Queen Elizabeth a charter under the title of Queen Elizabeth's Hospital, and a license to use armorial bearings, and in 1702 "the great Hospital," as it was called, was re-built at an expense of £2,471 ; the citizens subscribing over £2,000. It was established in its enlarged and improved buildings in 1706 with forty-four boys. About the middle of the last century, however, a time of adversity came upon the Hospital. In 1767, much to its detriment, the Hospital exchanged sites with the Grammar School in Christmas Street and was located in what had formerly been the Hospital of St. Bartholomew, close to the river Froom. For the next fifty years the Corporation continued to prey upon the funds of the Hospital ; the number of boys was reduced, the gifts given to it at its foundation were treated as loans, and the Hospital was charged compound interest on the debt thus falsely created. In 1821 the depredations of the Corporation were stopped by the Charity Commissioners, but it was not till 1842 that the Corporation surrendered the property belonging to the Hospital. This was the end of the period of adversity. In 1844 the trustees of the Hospital purchased the site on Brandon Hill and erected the present handsome buildings, and in 1875 the new scheme for the government of the Hospital was approved by Her Majesty in Council. The object of the school was defined to be "to supply a sound, practical and liberal education, not being merely elementary," and the

number of pupils was limited to 160, to be called Foundation Boarders ; of these, fifty were to be poor orphans who were to be eligible for admission between the ages of eight and ten years; fifty were to be boys who had attended for at least one year a public elementary school within the Parliamentary Borough of Bristol ; fifty were to be boys who had attended for the same period Queen Elizabeth's Day School or Carr's Day School, which were to be founded when funds should permit. Since the introduction of the new scheme the condition of the school has been in many ways one of increasing prosperity. The scholars have for many years distinguished themselves in the Cambridge Local Examinations and in the South Kensington Examinations, and several boys have passed by means of scholarships through the Grammar School to Oxford and Cambridge, where not a few have taken high honours. It has thus been made possible for boys to rise from a position of poverty and difficulty and secure for themselves a career of great usefulness. There has been only one interruption to this prosperity. Owing to agricultural depression the income of the Hospital has so sensibly decreased that the governors have found it necessary to decrease the number of Foundation scholars from 160 to under 130. The present head master is Mr. R. Jackson.

The second great Hospital School is the *Red Maids' School*, which does for girls a work similar to that which Queen Elizabeth's Hospital does for boys. This school was founded in 1628, in accordance with the will of Alderman John Whitson, "for the maintenance and education of forty poor women children, the said girls to be apparelled in red cloth, and to be in charge of a grave, painful and modest woman of good life and conversation." The school prospered so well that in the year 1875 the number of girls was 120. In that year a new scheme for the management of the school was approved by Her Majesty in Council, analogous to that sanctioned for Queen Elizabeth's Hospital. Girls generally leave the school at the age of 17—a few being allowed to remain till 18—and almost all pass either the Junior or Senior Cambridge Local Examinations. An

idea of the work done by the school may be obtained from the fact that of the pupils who have been there during the last seven years forty are elementary school teachers in or near Bristol and several are mistresses in High Schools throughout the country. In the case of girls therefore as of boys a real attempt is being made in Bristol to link together the elementary and the secondary education of the city and neighbourhood.

The last of the Hospital schools is Colston's Hospital, now called *Colston's Boarding School*. This foundation is due to Edward Colston, the generous citizen whose name lives as a proverb in Bristol. He died in 1721 and lies buried in the Church of All Saints, at Bristol, and beneath the canopy of his statue is the astonishing list of his public charities, amounting in all to over £70,000. Below this list are added the following words: "This great and pious benefactor was known to have done many other excellent charities, and what he did in secret is believed to be not inferior to what he did in public." This object of particular charity was "to educate in the principles of the Church of England 100 poor boys, to maintain and clothe them, and place them out apprentice." The boys were originally boarded in Colston's "Great House" in S. Augustine's Place—where the Colston Hall now stands—and there for a century and a half they remained. At last, however, the "Great House" became too much surrounded by houses and places of business to be suitable for a school, and in 1858 the Society of Merchant Venturers, who were the trustees of Colston's benefaction, determined to move the school out of the city altogether into the open country. This proposal aroused considerable opposition at the time, but the society persevered and were supported in their view by the Charity Commissioners. The vacated palace of the Bishop of Gloucester and Bristol at Stapleton was purchased; the building was enlarged and made suitable for a school-house, and the boys—who now numbered 120—moved into their present home in 1861. In 1875 a new scheme came into operation for this school as for the other Hospital schools. According to it the school is composed of Found-

ationers and Paying Scholars. The Foundationers are 100 in number—80 from Bristol and 20 from the adjoining counties of Gloucester, Somerset and Wiltshire. They must have attended for at least one year a Public Elementary School. The Paying Scholars receive the advantages of the school for about £30 a year. The age of admission is from ten years of age to twelve, and no boy is allowed to stay beyond the age of fifteen. The school enjoys, deservedly, a high reputation for its thorough and successful teaching. Its science and art classes are particularly good. The head master is the Rev. John Hancock, M.A., who for many years has now presided over the school.

Thus all the great Hospital schools are doing a valuable work for the education of those who otherwise would drift into the ignorant and discontented classes.

The third great group of Bristol Educational Institutions is composed of those that began to come into existence when the country had settled down after the long French war. It will be remembered that during the early years of this century the Grammar School had been allowed to degenerate from its position as the leading school of the city into a mere private school. This unfortunate circumstance forced those citizens who desired to see a school for higher education in Bristol to take measures for founding a new one to supply the place that ought to have been filled by the Grammar School. In 1829, therefore, Bristol College was founded, and in 1840 a similar college on more strictly Church of England lines. Neither College was successful; the Bristol College was closed in 1841 and the Bishop's College in 1851. The Bristol College, however, could boast of distinguished "alumni," among whom may be mentioned: Sir Edward Fry, afterwards Lord Justice; the Rev. S. W. Wayte, afterwards President of Trinity College, Oxford; Mr. G. G. Stokes, senior wrangler and afterwards Lucasian Professor at Cambridge; and Walter Bagehot, the well-known editor of the "Economist." The Bishop's College had the advantage of two distinguished masters—the Rev. H. Dale, and the Rev. J. R. Woodford, who was afterwards Bishop of Ely. It is possible that the unfortunate bitterness

caused by the rivalry of these two colleges was the cause of the premature end of both.

The next attempt to form a new school in or near Bristol was made on somewhat different lines. The Grammar School had now re-taken its proper position and was entering upon its brilliant career under Dr. Caldicott, but its position in Unity Street rendered it inconvenient for those who lived in the rapidly-increasing suburb of Clifton, and a company was therefore formed in May, 1860, to establish a college in Clifton, on the lines of the great public schools, which should admit boarders as well as day boys, and which should serve as a school for the West of England as well as for Clifton. *Clifton College* was opened in September, 1862, with fifty-eight boys, as a limited liability school, to educate boys in the principles of the Established Church. The Rev. J. Percival, afterwards, in succession, president of Trinity College, Oxford, and head master of Rugby School, and now Bishop of Hereford, was appointed the first head master. Under him the college advanced rapidly. In 1877 the liberality of the shareholders, who had never claimed any pecuniary advantage from their shares, enabled the school to obtain a royal charter and a conscience clause while the teaching still remained loyal to the principles of the English Church. The pupils of the school distinguished themselves at the Universities. The good work of Dr. Percival was carried on by his successors, the Rev. J. M. Wilson, now Archdeacon of Manchester, and the Rev. Canon Glazebrook, the present head master. The college has for many years ranked among the leading schools of the country. There are two points about the college perhaps that deserve special notice. While not neglecting the old classical training, it has been successful in passing a large number of its pupils directly into the Army, and it has also been successful in creating a feeling of attachment and unity among its day scholars which is not always found among the day boys at other public schools. Strictly, of course, it is not a Bristol school, but it has owed a great debt to Bristol, and has tried to do something to repay it by establishing a School Mission which worked in one of the

poor parts of the city till a parish was formed and a church built, and which is now directing itself to the support of boys' clubs in the city.

Eight years after the opening of Clifton College the Education Act of 1870 was passed, and the first School Board election in Bristol took place in 1871. Though the elections have often been spirited, the successive School Boards from 1871 to 1898 have been distinguished by the absence of sectional bitterness and by their zeal and unanimity not only in providing new and improved accommodation for the children but also in starting cookery classes and industrial schools and in framing and doing their best to perfect some sort of educational ladder which might lead from one school to another. Of the whole number of children receiving an elementary education in Bristol, rather more than half are being taught in the Board Schools, and there are now three Higher Grade Technical Schools established by the Board in different parts of the city—one in Bedminster, one in Montpelier, and one in S. George. Such care has been taken to combine economy with a high standard of efficiency, that the School Board rate has never been higher than 6½d. in the £. For this excellent work the city is indebted to many who are happily still alive, and to two who are no longer with us—the Rev. Dr. Caldicott, and Mr. Benjamin Wilson, formerly Master of S. Michael's School, the first Clerk of the Board.

One of the very first results of the impulse given to interest in educational matters by the Act of 1870 was the establishment of continuation or evening classes. After these classes had been in existence some four years their success had been so marked that the friends of education who had started them felt justified in making the attempt to put them on a more settled and permanent basis. By the assistance of the Bristol Medical School, of the Clothworkers' Company, and of two Oxford Colleges (Balliol and New College), *Bristol University College* was legally incorporated and opened its first session in 1876. The distinguishing marks of this great enterprise may be said to be these: Its Council is not purely local; it is kept in touch

with the elder Universities by having on its governing board representatives of Oxford, Cambridge and London ; it is not purely technical in the narrower sense of the term—ancient and modern history and ancient and modern literature are included in its course of instruction as well as what is strictly industrial and scientific. It is a technical school ; it is a medical school, for the Bristol Medical School has affiliated itself to it ; but it also aims at being a University ; and, lastly, it has the honour of being the first of the colleges that opened its doors to women. It has numbered among its principals and professors many distinguished men, as, for instance, Professor Marshall, Professor Ramsay, F.R.S., Professor Silvanus Thompson, Professor Rowley, and its present dean, Professor Lloyd Morgan.

Another evidence of the increasing interest in education may be seen in the action of the Society of Merchant Venturers in building on the historic site of the ancient City School and the ancient Grammar School the magnificent building which houses the *Technical College*. The history of this foundation is as follows. In the year 1812 a school called the Diocesan School had been established to educate the poor in the principles of the Church of England. The growth of Church Schools in the different parishes deprived this institution in time of a great part of its utility, and in 1855 it was converted into a Trade School—the first Trade School established in Great Britain. In 1875 the Endowed Schools Commissioners appointed the Society of Merchant Venturers trustees of the Trade School. Some may wish that the Society had been able to see their way to combine their school with the Bristol University College which was starting at that very time, for then Bristol would have had an institution that might have ranked along with the first in the country ; but no one can have anything but admiration for the liberality with which they re-built their own school and equipped it. The *Times*, of June 18, 1882, alludes to the building of it in the following terms : "The Merchant Venturers' Company, the only remaining trade guild of Bristol, has lately entered into a contract for erecting a very handsome and very complete building on the site of

the old Bristol Grammar School. It is to contain chemical, physical and metallurgical laboratories and lecture rooms, machine and geometrical drawing rooms, engineering lecture rooms and workshops. The building now in course of erection will cost more than £30,000, and the fitting and equipment of the lecture rooms and laboratories, libraries and museum will cost some £10,000 more. Certainly when a provincial guild like that of the Merchant Venturers can set so splendid an example of munificence and public spirit, there should be no fear for the future of technical education in the country." Since these words were written the College, under its vigorous and able head, Professor Wertheimer, has been almost year by year making fresh ventures and breaking new ground, and while, perhaps, it is still open to us to regret that we have not been able in this city to concentrate our efforts after improved and higher teaching for our people into one institution, we must still congratulate Bristol on the possession of two such great centres of education as the University College and the Technical College, and wish them both good speed in their kindred and all-important work.

Almost simultaneously with the incorporation and opening of Bristol University College, a *High School for Girls* was opened in Clifton, and a large mansion off College Road was acquired, enlarged and turned into a spacious school-house standing in its own grounds. Miss Woods was appointed first head-mistress. As might have been expected with such a distinguished teacher at its head, the school was a success from the beginning. It now consists of about 250 girls; these are mainly day scholars, daughters of residents in Clifton, but there has been from the beginning a boarding-house attached which is under the care of one of the mistresses of the school. Since the foundation of the school a beautifully-panelled school hall has been added, lawn-tennis courts added, and the grounds round the house enlarged. The present head-mistress is Miss K. Burns, and the high quality of the teaching given in the school may be estimated by the fact that in 1897 the Clifton High School stood second in England and third in the United Kingdom

in the number of certificates gained in the examination for the Oxford and Cambridge Higher School Certificates. It was a gratifying occurrence that in the same year the school that stood third in England and fourth in the United Kingdom in the number of senior certificates gained was also a Bristol school—the *Redland High School for Girls*. This latter school, which was founded some six years later than the Clifton High School, in the year 1882, to do an analogous work in the rapidly-increasing suburb of Redland, now consists of over 200 girls. The head-mistress is Miss Cocks, and the president and chairman of Council is the Bishop of Hereford. These two High Schools at Clifton and at Redland, though absolutely independent and administered by different Councils, have to a great extent been worked on the same broad lines and have done much in their different quarters of the city to raise the standard of liberal and intelligent education of girls. Like the Clifton High School, Redland is mainly a school for the daughters of the residents, but it also has a boarding-house under the care of one of the mistresses of the school. The Redland School offers a limited number of scholarships in conjunction with the Town Council of Bristol to encourage the literary as well as the scientific side of technical education.

There is another great Girls' School in Bristol which owes its foundation to the trustees of the Colston's Charity. It was opened in 1891. The school is worked under a scheme of the Endowed Schools' Commissioners and is for the accommodation of 300 girls between the ages of eight and seventeen. The girls are prepared for the Science and Art Examinations, the Junior and Senior Cambridge Examinations, and a few students for the Higher Local Cambridge Examination. There are ten scholarships awarded by the governors—five to elementary school children, two to girls already in the Colston's School, and three open to any children in Bristol. The head-mistress is Miss G. Amy Smith.

The last remaining of the schools concerned with girls' education is not a purely Bristol institution, though mainly supported by Bristol subscribers. It is the *Clergy Daughters'*

School in Great George Street. Originally established at Gloucester in 1831 to provide higher education at a moderate cost for the daughters of clergymen in straitened circumstances, it was, after a few years, removed to Bristol. The number of girls is limited to ninety, and the fees are about £30 a year. In 1862 it was settled in its present airy home on Brandon Hill, and now consists of three houses with gardens, lawn, and tennis courts, gymnasium, infirmary, and a large hall. The present head-mistress is Miss Billing.

This nearly completes a rapid survey of the principal colleges and schools of Bristol, but it would hardly be right to conclude without a glance at what has been done in the way of Industrial and Reformatory Schools. The pioneer in this work was a lady whose name will long be held in honour in Bristol—Miss Mary Carpenter. Owing to her influence a "Ragged School" was opened in Lewin's Mead in 1846. "None of the lads had shoes or stockings; some had no shirt and no home, sleeping in casks on the quay or on steps, and living by petty depredations. A night-school was soon added, bringing in a swarm of young men and women whose habits and character almost caused even the stout heart of Mary Carpenter to quail." Six years afterwards—in 1852—she obtained the establishment of a reformatory school for boys at Kingswood in the house where John Wesley had his college, and where his chapel still stands unaltered. In 1892 the school was practically re-built; capital schoolrooms, a good gymnasium, and well-ventilated workshops were added, and now 120 boys rescued from crime and temptation receive a sound and vigorous training both in mind and body. Boys are admitted for not less than three years.

A similar institution for girls was established two years after in 1854 and placed under Miss Carpenter's sole control. This is the *Red Lodge*, Park Row. When in 1877 Miss Carpenter closed her honoured life, a public meeting was held in the Guildhall, and it was resolved to establish the Mary Carpenter Home for Girls as a memorial of her unwearied exertions. A profile bust of Miss Carpenter was also placed in the Cathedral.

The example set by Miss Carpenter was followed by others. In 1869 it was determined to establish a training ship for homeless and destitute boys. The Admiralty granted the loan of an old eighty-four, the *Formidable*, which now lies in Kingroad, and in which more than 2,000 boys have been trained and taught, have been rescued from misery, have become British sailors, or have gone into other departments of active life. Industrial schools have been also established—one for girls in Kingsdown, and two for boys in Clifton Wood and in Park Row. While the *Formidable* and the Kingswood Reformatory are doubtless the most picturesque and attractive of these institutions, it is impossible to overestimate the value of the work done and the training given in them all.

Finally, on Ashley Down, stand George Müller's Orphanages, the appropriate memorial of a remarkable and earnest life

BRISTOL PUBLIC LIBRARIES, PAST AND PRESENT.

By E. R. NORRIS MATHEWS, City Librarian, Member of Council of the Library Association, F.R.Hist.S., etc.

In the history of British public libraries the ancient city of Bristol fills a prominent position. Not merely does its city library possess great historical interest of unique character, but its successful development under the operation of the Public Libraries Acts of recent years, places it in the front rank of municipal libraries. Without doubt a free public library existed in Bristol early in the fifteenth century, which was maintained by a religious fraternity called the *Kalendaries* or *Calendaries*, who were attached to the Church of Al-Hallowen or All Saints. The Calendars were also a guild of literature and the custodians of the library. At specified times all willing to enter for the sake of instruction were granted free access. It was, moreover, duly required that the prior should "lay open doubtful and obscure places of Scripture to all that ask him," and should "read a *public lecture* every week in the said library according to the appointment of the Bishop of Worcester." The library was situated over the north aisle of the church, each book being secured by a chain. Three inventories or catalogues of the whole collection were kept, one by the mayor, one by the dean, and the third by the prior or librarian. The library and contents, with the exception of a few manuscripts, perished by fire in the year 1466. Amongst the manuscripts, however, that escaped destruction was the important civic document known as the "Mayor's Kalendar," which is now preserved in the Council House.

Of quite distinct origin from the semi-monastic public library of the Calendars, was a library established for the free use of the people of Bristol in the year 1613. Robert Redwood, a Bristol merchant, then gave for the purpose his lodge "neere the Marsh, to be converted to a librayre." At the same time Dr. Tobias Mathew,

Archbishop of York, who was born in Bristol, gave to his native city a number of his books, to which were subsequently added, by bequest, a considerable portion of his library to be preserved "for the free use of the merchants and shop-keepers of the city." In 1740 the present building was erected on the site of the old library, the corporation retaining the exclusive management until 1773, when the control of the library appears for a time to have been vested in the Bristol Library Society, a private institution which was formed in that year. The Library Society removing to another building in 1855, the City Library then resumed its primary character as a public Free Library. With the appointment of the late Mr. George Pryce in 1856 to the office of city librarian, the institution rapidly revived, and books were added to the permanent collection: a large number of books and pamphlets especially relating to Bristol history were also brought together by Mr. Pryce, who was himself the donor of a great many. To this devoted librarian belongs the credit of having been the first to collect materials of local history for the Public Library, an example which has since been followed by the authorities in almost every public library in England.

The Public Libraries Act was adopted at Bristol in 1874, and the old City Library became the central establishment, around which have since grown up large district public libraries at St. Philip's, Bedminster, Redland, Hotwells, the North District, and a small lending library at Avonmouth. The popularity and usefulness of these institutions is shown by the increasing demand for their extension. A fine library building for the populous district of St. George, which is the gift of Sir W. H. Wills, Bart., to the city, has just been erected; and, with the recent enlargement of the city area, libraries for other newly-added districts will doubtless be provided ere long. At the present time the public libraries contain about 100,000 volumes. There is also a large library attached to the Bristol Museum, which is reserved for reference only. Each branch library has its lending and reading department

and news-room, a liberal supply of newspapers, magazines and reviews being provided. During last year there were two million visits to the news-rooms and reading-rooms, while the issue of books averaged 2,000 volumes daily. The number of borrowers and readers forms a considerable percentage of the population, and represents all classes of the community.

The City Library in King Street, although totally inadequate to the requirements of a modern central public library, has considerable historic interest, it being with one exception* the first established in England after the Reformation. A century ago Samuel Taylor Coleridge, Robert Southey, Walter Savage Landor, and Sir Humphry Davy were amongst its most regular frequenters. In the room now used for lending library purposes may be seen the oak book-presses, and also the exquisitely carved mantelpiece by Grinling Gibbons, which is reputed to be one of the finest specimens of that artist in England. In the library are carefully preserved the old books which comprised the "Mathew bequest." Some of them contain the autograph of the illustrious donor. As an instance, the "Conciliorum Omnium" (1567), by Laurentius Surius, contains the following inscription:—

"Tobis Matthew. Vita Christus, mors Lucrum."

and on the cover of Salmeronis Commentarii (1602) may be seen the arms of the Archbishop.

SOME PARTICULARS OF A FEW OF THE ILLUMINATED MANUSCRIPTS AND EARLY PRINTED BOOKS PRESERVED IN THE LIBRARY:—

Manuscripts.

A Latin Bible, on vellum, consisting of 279 leaves. Written and illuminated by a thirteenth century scribe. This magnificent work is known as the "Corporation

* That of the Corporation free library of Norwich, which was founded five years previously, viz. in 1608, and has maintained its privileges in unbroken record to the present date.

Bible." Tovey, in his History of the Bristol Library, p. 32, quotes the following entry from the city records :—

> "May 12th, 1785. On the motion of Mr. Harford it is unanimously agreed and ordered, that a Latin Manuscript Bible, now in the Chamberlain's office, be forthwith sent to the *Public Library* in this city, and there deposited with the other books and manuscripts belonging to this Corporation under the care of the Librarian."

A Latin Dictionary, on vellum, consisting of 180 leaves. The manuscript, with illuminated initial lettering, is attributed to the thirteenth century.

Lombard (Peter). Sententiarum Libri Quatuor, on vellum, consisting of 105 leaves, attributed to the thirteenth century.

Isidorus *Hispalensis.* **De Summo Bono.,** etc., on vellum, consisting of 116 leaves, illuminated, attributed to the fourteenth century.

Sermones Sive Conciones Quadragesimales, on vellum, consisting of 103 leaves; the last page mentions the date 1408.

Lydgate (John). The History of Troy, on vellum, consisting of 120 leaves, written and illuminated by an English scribe about 1420.

Bartholomew, *Anglicus.* **De Proprietatibus Rerum,** translated into English by **John de Trevisa.** On vellum, consisting of 137 leaves profusely illuminated; written by an English scribe probably in the beginning of the fifteenth century. This work unfortunately has been much mutilated.

Chauliac (Guy De). Chirurgie, consisting of 289 leaves. The curious illustrations show the surgical instruments, methods of performing operations, and the costume of medical men in the Middle Ages. A manuscript note on the fly-leaf states that "it was written by John Tourtier, *magister chirurgia,* by order of John, Duke of Bedford and Regent of France, about 1423."

An English Missal, on vellum, consisting of 153 leaves, written and illuminated in the fifteenth century.

Several miscellaneous Treatises in Latin and English, written at the monastic house of S. Mark, Bristol in (?) 1502. On vellum, consisting of 140 leaves. The initial letters are illuminated.

Early Printed Books.

(INCUNABULA.)

Many of the following works possess specimens of antique illumination, and are preserved in their original bindings; in some instances, also fragments of the book-chain remain attached :—

Printed at Venice, 1479. — Mesue (Johannis) Opera. [*Impensis Rainaldi Novimagii teutonici; Venetiis.* 1479.]

Printed in 1480. — Turrecremata (J. de). Questiones Euāgeliorum. [1480 ?].

Printed at Parma, 1481. — Plinius Secundus (Caius) Historia Naturalis, *opera & impesa Andreæ Portiliæ: Parmæ*, 1481.

Printed at Venice, 1483.—Orosius (Paulus) Historiarum initium ad Aurelium Augustinum. *Impressi . . . Octaviani Scoti . . . Venetiis*, 1483.

Printed at Deventer, 1484.—Turrecremata (J. de) Flos Theologiæ. *Attributed by Dibdin to Paffroet: Deventer*, 1484.

Printed at Strasburg (?) about 1484. — Fasciculus tēpo omnes antiquorum cronicas complectēs. [1484 ?]

Printed at Basle, 1486. — Petrus, *Comestor.* Historia Scholastica. [*M. Wensler*:] *Basilee*, 1486. This book contains the autograph and also manuscript notes of Archbishop Mathew.

Printed at Venice, 1486.—Sallustius Crispus (Caius) *Begin:* Omnes homines qui sese student præstare cæteris animalibus, *etc.* [*Venice*, 1486.]

Printed at Venice, 1489.—Aristotle. Omnia opera cū cōmēto Averrois. *Per Bernardinum de Tridino de Monteferato: Venetiis*, 1489.

Printed at Siena, 1490.—Justinus et Florus. *Attributed to the press of H. de Colonià : Sienne*, 1490.

Printed at Basle, 1491.—Antoninus [Forciglioni] *Saint, Archb. of Florence.* Prima—tertia pars historialis domini Antonini. *Nicolaum Kessler : in Basilea*, 3 vols., 1491.

Printed at Nuremberg, 1493. — Schedel (Hartmannus) Chronicon Nurembergense. *A. Koberger : Nuremberg*, 1493.

Printed at Strasburg, 1494 and 1502. — Charlier de Gerson (Jean) [parts i, ii, iii]. Operum Johannis Gerson. *Simus Martinus : Argentina*, 1494. [Part iv.] *M. Flaccus : Argentina*, 1502.

Printed at Venice, 1494. — Vincentius *Bellovacensis.* Speculum historiale Vincentii. *H. Liechtenstein : Venetia*, 1494.

Printed at Venice, 1495. — Livius (Titus) *Patavinus.* T. Livii Decades. *Per P. Pincium : Venetiis*, 1495.

Printed at Strasburg, 1496.—Sabunde (Raymundus de) Theologia naturalis. *Per Martinum Flach : Argentine*, 1496.

Printed at Venice, 1496.—Valla (Laurentius) De elegantia linguæ latinæ. *Per Cristoferum de pensis : Venetiis*, 1496.

Printed at Nuremberg, 1497.—Cicero (Marcus Tullius) De Oratore. *A. Koberger :* [*Nuremb.*] 1497.

Printed by Pynson, London, 1499. — Frauncis (Richard) Promptorium parvulorum. *Richard Pynson :* [*London*] 1499. Contains the device of Pynson.

The First Polyglot Bible, popularly known as the "Complutensian Polyglot," after the place of printing. *A de Brocario : Complutum* [*i.e., Alcala*] 1514-17. Produced at the expense of Cardinal Ximenes. The New Testament portion was printed in 1514 ; and the Old Testament in 1517 ; but though printed at these dates the sanction of

Pope Leo X. (see vol. i.) was not obtained till 1520, and the work was probably not in circulation until the year 1522.

Anglerius (**Petrus Martyr**) De orbe novo decades. *Alcala de Henares*, 1516.

The celebrated Genevan Testament. *C. Badius: Geneva*, 1557.

Milton (**John**) Paradise Lost. First issue of the first edition. *Peter Parker: London*, 1667.

Besides the examples of early typography already mentioned, there are also several by the following distinguished printers:—Koberger, Amerbach, Froben, Stephens, Scotto, Aldus, J. Badius, Liechtenstein, Notary, Wéchel, Plantin, Day, Henricpetri, Petit, etc.

*** A fuller description of the foregoing typographical rarities will be found in the special catalogue of the Books printed between 1479 and 1628, contained in the Central Public Library, Bristol, including the "Mathew bequest."

SCIENTIFIC SOCIETIES.

THE CLIFTON ANTIQUARIAN SOCIETY was founded in 1884 for the investigation of the antiquities of the city and neighbourhood. In a city of such great historical interest a rich field for research is open, and the society has already done much good work and published during its life three volumes of transactions. The membership is limited to fifty ordinary and ten honorary members. The first president was the Rt. Rev. Bishop Clifford, who held the office till his death in 1893, being succeeded by Col. Bramble, F.S.A., who still retains that post. The hon. secretary is Mr. Alfred E. Hudd, F.S.A., who also has edited the Proceedings since the commencement. During the summer months excursions are made to places of interest, and in the winter papers are read at the meetings.

THE BRISTOL NATURALISTS' SOCIETY was founded in 1862 and occupies rooms in the Literary and Philosophic Club, Berkeley Square. Meetings are held in the winter months and excursions are made in the summer. Since its foundation several sections have been added for the study of special subjects, such as botany, chemistry, entomology, geology and ornithology, but persons can join these sections without becoming full members of the society. There are 145 members and 14 sectional members. The meetings are held on the first Thursdays in each month from October to May, and the sections meet monthly. The society publishes annually "The Proceedings of the Bristol Naturalists' Society."

BRISTOL AND WEST OF ENGLAND AMATEUR PHOTOGRAPHIC ASSOCIATION.—There are not more than half-a-dozen societies in the kingdom (having objects devoted entirely to photography) that can show a longer record than the Bristol and West of England Association. The first

meeting was held in 1866, and for many years it was the only Amateur Photographic Society in the Western Counties. In 1876 there was a large increase in the number of members from all parts of the district, but the formation of societies in the neighbouring towns, which occurred a few years later, caused a gradual but complete change in the *personnel* of the Association, the present members (numbering about seventy) being almost entirely residents of Bristol and the suburbs.

Although not one of the largest Photographic Societies, it has had at all times prominent workers in the photographic world, and amongst those who have at various periods undertaken the duties of President or Vice-President may be mentioned the late City Analyst, Mr. W. Walter Stoddart, who held the office of President to the time of his death, in 1880; Colonel Thos. Biggs, Mr. Thomas Davey, Rev. W. J. Whiting, Rev. C. B. Hare, Mr. H. A. Hood Daniel, Dr. Hy. Ormerod and Mr. Edward Brightman.

Mr. F. Bligh Bond, for some time hon. secretary, was one of the pioneer workers of the "three-colour process," and his article upon the subject in the "Photographic Quarterly," of July, 1890, caused at the time much comment and undoubtedly gave an impetus to that branch of photography.

International Photographic Exhibitions have been held by the Society at intervals since 1880 in the galleries of the Fine Arts Academy, Queen's Road, and have taken first rank in the kingdom for the quality of the work shown and for the large number of exhibits collected from all parts of the world.

The Society possesses some 300 paper negatives taken forty and forty-five years ago, many being unique and of interesting architectural subjects no longer existing.

During the winter the ordinary meetings are held at the Literary and Philosophic Club, 20, Berkeley Square, on the second and fourth Fridays in each month, and frequent excursions are made in the summer. In the Society's Reading and Dark rooms apparatus is provided to meet all requirements of the members.

The present officers are :—President, Mr. H. A. Hood Daniel ; Vice-Presidents, Colonel Playfair and Mr. Edward Brightman ; Treasurer, Mr. William Moline ; Hon. Secs., Mr. Edward Brightman, of Lyndale, Redland Road, and Mr. M. Lavington, 5, The Avenue, Redland Road ; Committee, the above officers with Messrs. T. Butler, Sidney J. Hill, H. O. Isaac, T. Letchford and W. Norgrove.

Bristol Incorporated Law Society, Assize Courts, Small Street.—This Society, which had been in existence for a great number of years, was Incorporated in 1871. Number of members, 193. Annual ordinary general meetings generally held in October in each year. Council consists of president (Mr. W. C. H. Cross), two vice-presidents (Mr. T. D. Sibly and Mr. C. E. Barry), and two honorary secretaries (Mr. W. W. Ward and Mr. J. N. C. Pope), and fifteen ordinary members, three of whom retire by rotation annually. Council meetings are held on the first Monday in each month in the Law Library, Small Street. Library contains about 7,500 books and is considered one of the best law libraries out of London. Preliminary law examinations are held in the library four times in each year.

British Medical Association : Bath and Bristol Branch.—With one exception (the East Anglian Branch) this Branch—or rather the Bath division of it—is the oldest in the Association. The first steps to inaugurate a District Branch of the Provincial Medical Association in this neighbourhood were taken at Bath, November 18th, 1836, when a few influential members of the profession met and decided upon the formation of the Bath District Branch, of which Mr. W. Tudor, Serjeant-Surgeon to the King, was the first president, and Dr. Barlow secretary. The Bristol Branch was formed in 1839 ; Dr. J. C. Prichard being the first president, and Mr. Hetling secretary. In 1842 a proposal was made to amalgamate the Bath Branch with the Bristol ; and in consequence the Bath and Bristol

Branch was formed, consisting of 119 members, including many from the country around the two towns.

For some years the Branch was managed by a council, consisting of eight members from Bath, eight from Bristol, and eight country members ; and the president was chosen annually in rotation from each division ; but since 1850 the council has consisted of twelve members elected in the Bath district, and twelve in the Bristol district, each including its neighbouring country range. Each district has its own secretary. The annual meetings were held alternately in Bath and Bristol, the president for the year being resident within the district in which the meeting was held. The first meeting on the list, that in 1841, was held in Bristol.

Seven ordinary meetings of the Branch are now held yearly during the session between October and May, three at Bath and four at Bristol ; and numerous papers bearing on the science and practice of medicine have been read and discussed at them. The Branch has also taken cognisance, from time to time, of medical reform and other matters connected with the interest of the Association and of the profession and public.

The first annual meeting of the Association, after its formation at Worcester in 1832, was held in Bristol in 1833 under the presidency of Dr. Carrick. Since the original formation of the Branch, there have been five meetings in the district : at Bath in 1838 (Dr. Barlow, president), in 1848 (Mr. G. Norman, president), and in 1878 (Dr. R. W. Falconer, president) ; at Bristol in 1863 (Dr. J. A. Symonds, president), and in 1894 (Dr. E. Long Fox, president).

At the present time the Branch contains 266 members, mostly resident in Somerset, Wiltshire and Gloucestershire.

THE BRISTOL MEDICO-CHIRURGICAL SOCIETY commenced its highly useful and successful career in the year 1874, when, at a preliminary meeting held on February 24th under the chairmanship of Mr. Crosby Leonard, forty-four members were enrolled and Dr. Frederick Brittan was elected president, with Mr. R. W. Coe as vice-president and Dr. Shingleton Smith as secretary.

In 1882 it was resolved "That in the opinion of this Society the time has come when the various medical and surgical interests of the West of England ought to be united by the publication of a periodical journal, which might appear under the auspices of the Bristol Medico-Chirurgical Society." Accordingly, a journal was published, at first half-yearly, but in its second year it became quarterly, under the editorship of Mr. James Greig Smith, who conducted it with great ability through the first ten years of its existence. Since that time the Bristol Medico-Chirurgical Journal has continued to appear quarterly under the editorship of Mr. Shingleton Smith assisted by an editorial committee now constituted as follows :—J. Michell Clarke, M.A., M.D.; F. Richardson Cross, M.B.; W. H. Harsant, F.R.C.S.; J. Swain, M.D., F.R.C.S.; L. M. Griffiths, M.R.C.S. assistant editor; B. M. H. Rogers, B.A., M.D., B.Ch., editorial secretary.

Another outcome of the life of this Society has been the establishment of a medical library which was commenced in 1890, first in a room at the Literary and Philosophic Club, in Berkeley Square, under the exceedingly able and successful management of Mr. L. M. Griffiths, but this library grew so rapidly that ere long it was found necessary to transfer the books to the more capacious and suitable room built for a library in the medical wing of University College, Bristol. Here the medical library is now situated, and the librarian has been successful in placing under one roof the various collections of medical books belonging to the Medical School, the Royal Infirmary, the General Hospital, and the City Library. This collection now numbers 14,000 volumes and forms an exceedingly good reference library for the West of England and South Wales. A reading room in the building is reserved for the use of the members of this Society.

The Bristol Scientific Club owes its initiation, in the year 1888, to several of the leading local scientific men, who felt that it was desirable to bring together those who felt real interest in science in all or any of its branches.

The members—limited to fifty in number—dine together and afterwards discuss some subject which is introduced by one of the members, and by these means many original papers and friendly discussions on important scientific matters of the day have been brought before the members of the club. That it is fully representative of the scientific thought of Bristol is shown by the fact that the movement leading to the invitation of the British Association to Bristol had its origin at one of the meetings of the club in 1897.

INDEX.

PAGE

A.

Almshouses - - 76, 156
American Trade - - 61
Annuities, Pensions, etc. - 150
Antiquarian Society - 228
Architectural Features - 71
Associations—
Amateur Photographic - 228
British, 1835 - - 135
— 1875 - - 138
— 1898 - - 143
British Medical, Bath and Bristol Branch - 230
Asylums, etc. - - - 158
Avon Section - - - 15
Avonmouth Dock - 110, 140

B.

Backwell - - - - 34
Barrows, Long - - 40
— Round - - 41
Bath - - - - 52
Bell Foundries - - 119
Birds - - - - 192
Bishop's College - - 214
Books, Early Printed - 225
Botany - - - - 181
— Medical - - 187
Brewing - - - 120, 129
Bristol Commerce and Industries - - - 116
Bristol in Roman Times - 51
— Architectural Features 71
— Castle - - 58, 61, 76
— Cathedral - - - 71
— Churches - - 71

PAGE

Bristol Civic Buildings - 77
— College - - - 213
— Docks - - - - 66
— Exchange - - - 63
— Extension Act, 1897 - 143
— Grammar School - 207
— High School - - 217
— Paper Trade - - 119
— Port - - - 108, 140
— University College - 215
British Association Meeting, 1835 - - - 135
— — — 1875 - - - 138
— — — 1898 - - - 143
British Camps - - - 41
Brush Making - - - 120
Bryozoa Bed - - - 14

C.

Cabinet Making - - 120
Cabot Tower - - - 80
Cainozoic Deposits - - 26
Camps, British - - 41
— Clifton - - - 42
— Stokeleigh - - - 44
Carboniferous Series - 14
Carriage Builders - - 121
Cathedral - - 60, 71
Cathedral School - - 209
Celestine - - - - 22
Charities - - - - 154
Chocolate and Cocoa - 119
Church—
St. James' - - - 74
St. Mark's - - - 75
St. Mary-le-Port - - 74

PAGE

Church—
St. Mary Redcliffe - 72
St. Philip & St. Jacob - 75
St. Stephen's - - 75
Temple - - - - 73
Churches - - - - 71
City School - - - 209
Civic Buildings - - 77
Civil War, Attack on Bristol - - - - 61
Clergy Daughters' School 218
Clifton College - - 214
Clifton, Growth of - - 65
— Down - - - - 70
Coalfields - - - 128
Coal Measures - - 19
Cocoa and Chocolate - 119
Coins of Ethelred and Cnut - - - - 56
— Roman - - - 54
Coleoptera - - - 205
College—
Bishop's - - - 213
Bristol - - - - 213
Clifton - - - - 214
Merchant Venturers' Technical - - 69, 216
University - - - 215
Colston School - - 212
Commerce and Industries 116
Corrugated Iron - - 122
Cove - - - - - 39

D.

Damery Bridge - - 12
Denudation, sub-aerial - 28
Docks, Avonmouth - 66, 109
— Bristol - - 110, 140
— Portishead - - 110, 140
Dolmens - - - - 40
Dolomitic Conglomerate 20, 38

PAGE

Domesday Book - - 58
Downs, Clifton and Durdham - - - - 70
Dundry - - - - 25
Durdham and Clifton Downs - - - - 70

E.

Educational Organisation 207
Electric Lighting 125, 145, 151
— Tramways - - - 126
Exchange - - - 63
Extension Act, 1897 - - 143

F.

Faults - - - - 27
Fish Remains - - 13, 16
Floating Harbour - - 109
Flora - - - - 181
Forest of Dean - - 18

G.

Gas Works - - - 125
Girvanella - - - 18
Glastonbury Lake Village 47
Grain - - - - 122
Grammar School - - 207
Growth of Trade - - 115
Gully Oolite - - 16, 17

H.

Health, Public - - - 173
History of Bristol—
Mediæval and Modern - 56
Roman Times - - 51
Holy Cross Church - - 73
Hospital Isolation - - 176
Hospital, St. Peter's - 79
Hospitals, Infirmary, &c. 155
Hotwells - - - - 64
Hymenoptera - - - 205

PAGE

I.

Igneous Rocks - - 12, 19
Incorporation of the Poor 136
Indebtedness, Municipal - 148
Industries and Commerce 116
Inferior Oolite - - - 24
Infirmary, Hospitals, &c. 155
Insects - - - - 204

K.

Keuper - - - - 20

L.

Lake Dwellings - - 48
Lake Village, Glastonbury 47
Leather - - - - 117
Lias - - - - - 23
Libraries, Public - - 221
Libraries Act, 1874 - - 222
Library Society (1773) - 222
Lighting—
  Electric Light 125, 145, 151
  Gas - - - - 125
Local Government and
  Taxation - - - 135
Locomotives, Trade - 127
Ludlow - - - - 11

M.

Mæsozoic Deposits - 21, 25
Mammals—
  Carnivora - - - 201
  Cheiroptera - - - 203
  Insectivora - - - 202
  Rodentia - - - 200
Man, Neolithic - 37, 40
— Palæolithic - - - 35
Manuscripts in Bristol
  Library - - - 223
Mayor's Chapel - - 75
Megalithic Stone Circles 38
Merchant Venturers' Tech-
  nical College - - 217

PAGE

Merchants' Hall - - 80
Meteorology - - - 164
Midford Sands - - 24
Millstone Grit - - - 17
Monastic Remains 71, 75, 76
Mortality - - - - 180
Municipal Indebtedness - 148

N.

Naturalists' Society, Bristol
  192, 204
Neolithic man - - 37, 40

O.

Oil Cloth - - - - 120
Old Red Sandstone - - 12
Orphan & other Asylums 158

P.

Palæolithic man - - 35
Paper Trade - - - 118
Parliament held in Bristol 59
Pensions, Annuities, &c. - 160
Petroleum - - - 128
Plague - - - 60, 173
Poor Law - 136, 138, 143
Pope on Bristol - - 66
Port of Bristol - - - 108
Port Preventive Work - 178
Portishead Dock - 110, 140
Post Office - - - 131
Pottery - - - - 129
Prehistoric Archæology - 38
Provisions - - - 122
Public Health - - - 173
Publishing - - - 119

Q.

Quoit - - - - 39

R.

Rainfall - - - - 166
Rates and Rateable Value
  140, 150

	PAGE
Red Maids' School	211
Reformatory Schools	219
Reptiles—	
Ophidia	195
Pisces	196
Squamata	195
Urodela	195
Rhœtic	22
Roman Roads	53
Roman Times, Bristol in	51

S.

Sanitary Condition	150
Schools—	
Cathedral	209
City	209
Clergy Daughters	218
Colston	212
Colston Girls'	218
Grammar	207
High, Bristol	217
High, Redland	218
Higher Grade	215
Red Maids'	211
Reformatory	219
School Board	144
Scientific Club, Bristol	232
Severn Tributaries	27
Sewerage	175
Silurian	11
Slave Trade	26
Societies, Scientific—	
Antiquarian	228
British Medical Assoc. Bath & Bristol Branch	230
Incorporated Law	230
Medico-Chirurgical	231
Naturalists'	228
Photographic	228
Society of Merchant Venturers	68
St. Augustine's Monastery *(see Cathedral)*	60
St. James'	74
St. Mark's	75
St. Mary-le-Port	74
St. Mary Redcliffe	72
St. Peter's Hospital	79
St. Philip and St. Jacob	75
St. Stephen's	75
Stanton Drew	38
Stone Circles, Megalithic	38
Sub-aerial Denudation	28
Sugar	124

T.

Tanneries	117
Technical Schools	215
Temperature	172
Temple Church	73
Tertiary Deposits	26, 31
Timber	122
Tobacco	123
Trade, growth of	115
Trade of Bristol	141, 147
Tramway Co.	126
Tramways, Electric	126
Triassic Strata	20

U

Upper Llandovery	12

W.

Waggons	131
Wansdyke	46
Water Works Co.	125, 174
Wickwar	18
Woollen Trade	121
Worlebury	45

Z.

Zymotic Death Rate	179

1437.98 JOHN WRIGHT AND CO., PRINTERS, BRISTOL.

C. H. CHIVERS,

Cook and Confectioner,

WINE & SPIRIT MERCHANT,

6, ROYAL PROMENADE, CLIFTON,

AND 76, STOKES CROFT.

The Largest and Best Appointed Luncheon Rooms in Clifton.

WEDDING BREAKFASTS,
AT HOMES, . . .
DINNERS, ...
BALLS, &c., . . .

WITH EVERY REQUISITE, CONTRACTED FOR.

Four Gold, Silver & Bronze Medals, and Five Diplomas awarded in Open Competition, Confectioners' International Exhibition, London, 1896

Table Appointments of every description on Hire.

PRICE LIST ON APPLICATION. TELEPHONE 5650.

The Redland High School for Girls,

REDLAND COURT.

President and Chairman of Council:
THE LORD BISHOP OF HEREFORD.

Vice-Presidents:
HERBERT THOMAS, Esq., J.P. | MARK WHITWILL, Esq., J.P.
Professor C. LLOYD MORGAN.

Head Mistress: Miss E. A. COCKS.

Boarding House, Miss Cayley (2nd Mistress)—
GORDON HOUSE, CLARENDON ROAD.

THE SCHOOL provides a **Literary and Scientific Education for Girls,** of as thorough and liberal a nature as Boys receive in Grammar schools of the highest class. The Physical Training includes Gymnastics, Swimming, Cricket, Lawn Tennis, and other out-door games.

Information as to the Boarding House, and as to the Entrance, Council, and Bristol Town Council Scholarships tenable at the School, may be obtained from the Head Mistress, Redland Court, or from the Secretary—

A. G. N. TRIBE, Albion Chambers, BRISTOL.

Clifton High School for Girls.

Council.

PRESIDENT—LEWIS FRY, ESQ., M.P.

MISS H. N. ABBOT
REV. CANON AINGER, LL.D.
F. M. ALLEYNE, ESQ., M.A.
W. W. ASQUITH, ESQ., M.A.
MRS. H. C. BARSTOW.
REV. CANON CORNISH, M.A.
W. J. FYFFE, ESQ., M.D.
MRS. GLAZEBROOK
JOHN HARVEY, ESQ.
PROF. LLOYD MORGAN
MISS OGILVIE
MRS. G. H. POPE
REV. URIJAH R. THOMAS
REV. H. ARNOLD THOMAS, M.A.
REV. CANON WALLACE, M.A.
A. H. WANSEY, ESQ.
MISS WINKWORTH
G. H. WOLLASTON, ESQ., M.A.
MRS. WOLLASTON

Hon. Secretary.

H. C. BARSTOW, ESQ., 2, ALBERT ROAD, CLIFTON.

Secretary.

MISS DINGWALL.

Head Mistress.

MISS BURNS,

Glasgow University Higher Certificate and Society of Arts Examination

Assistant Mistresses.

MISS HURST,

B.Sc. London, Silver Medallist in Botany, University College, London.

MISS McCROBEN,

Cambridge Higher Local Examination, and LL.A. St. Andrew's.

MISS PURDIE,

Classical Tripos, Cambridge, and Cambridge Higher Local Examination.

MISS H. M. LEONARD, *Trained Kindergarten Mistress*

MISS E. M. MARSHALL.

MISS DERBYSHIRE, *Historical Tripos, Cambridge.*

MISS CAYLEY,

Cambridge Higher Local Examination.

MISS RITSON,

Cambridge Higher Local Examination, Certificate Collége de France.

MISS TATE,

Honour School of Mathematics, Oxford.

MISS TOD,

London University Matriculation.

MISS E. KELSALL,

Cambridge Higher Local Examination.

MISS NICHOLSON,

Classical Tripos, Cambridge, and Cambridge Higher Local Examination.

BOARDING ARRANGEMENTS.—There is a Boarding House connected with the School, under the direction of Miss BURNS, at 2, Cecil Road, for the reception of Girls from a distance. Fees and other particulars may be ascertained on application to the Secretary, who will also supply, if desired, the names of Ladies willing to receive Girls privately into their own homes.

ESTABLISHED A.D. 1797.

M. W. DUNSCOMBE,

FELLOW BRITISH OPTICAL ASSOCIATION;
FREEMAN OF THE SPECTACLE MAKERS' COMPANY, LONDON;
FELLOW ROYAL METEOROLOGICAL SOCIETY;

(*Successor to BRAHAM,*)

Optician and . . . . Spectacle Specialist,

10, ST. AUGUSTINE'S PARADE, BRISTOL.

Private Room for Sight Testing and Spectacle Fitting.

Exhibitor's Medal - Great Exhibition, A.D. 1851;
Patent for Improvement in Folder, A.D. 1862;
Honourable Mention - London Exhibition, A.D. 1862;
Gold Medal Award - Victorian Era Exhibition, A.D. 1897.

PHOTOGRAPHIC APPARATUS of all Kinds.
DARK ROOM for Use of Customers.
STEREOSCOPES AND PHOTOGRAPHIC VIEWS OF BRISTOL.

OPTICAL LANTERNS AND SLIDES (40,000).
Lectures, Garden Parties, Tableaux Vivants, &c.,
. . . . Illuminated with Lime Light.

OPERA and FIELD GLASSES, TELESCOPES, MICROSCOPES, BAROMETERS, THERMOMETERS, RULES, SCALES, &c

M. W. DUNSCOMBE, Optician and Spectacle Specialist,
F.B.O.A., F.R.Met.S.
10, St. Augustine's Parade, BRISTOL.

Please Note: DUNSCOMBE, late BRAHAM.

J. FULLER & CO.,

Coach Builders,

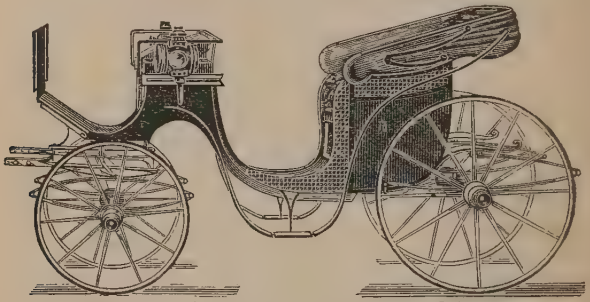
ST. GEORGE'S ROAD,

NEAR COLLEGE GREEN.

TELEGRAPHIC ADDRESS—
"CHARIOT, BRISTOL."

TELEPHONE No. 319.

Amalgamated with
JOHN BARTON & SONS,
(*Established* 1813,)
QUAY HEAD, BRISTOL.



(At the Foot of Brandon Hill and the Cabot Tower.)

ESTABLISHED 1770.

EXTENSIVE SHOWROOMS.
CARRIAGES BUILT FOR EXPORT.
ESTIMATES GIVEN FOR REPAIRS.
CARRIAGES SOLD ON COMMISSION.

The Largest Stock of . . . .
NEW & SECOND-HAND CARRIAGES of all Descriptions,
. . . In the West of England & South Wales.

BRISTOL.

CHELSEA PUBLIC LIBRARY

CHELSEA PUBLIC LIBRARY

Reference Department

20 JAN 1953

"Only the Best."

HYACINTHS, TULIPS, NARCISSUS, &c.

GARAWAY & CO.

SUPPLY

ROMAN HYACINTHS

4¾-inch and over ... **2/3** per doz.; **12/-** per 100

DUTCH HYACINTHS

Second size, named ... **2/9** per doz.; **18/-** per 100
„ „ in colours **2/6** „ **16/-** „
First size, best named, from ... ... **4/-** per doz.

TULIPS

From ... ... **2/6** per 100

CROCUS

From ... ... **1/3** per 100

2d. *on* **1/-** *discount off the above prices for "Cash with Order."*

ROSES

Dwarf Plants, best H.P. varieties, to name. From open ground in October. **35/-** per 100; **20/-** per 50
Net Cash.

FRUIT TREES of every description.

GARAWAY & Co.

Durdham Down Nurseries,

CLIFTON.

KW-227-296